Changing Perspectives on the Internationalization of R&D and Innovation by Multinational Enterprises. A Review of the Literature

ABSTRACT

Internationalization of R&D and innovation by Multinational Enterprises (MNEs) has undergone a gradual and comprehensive change in perspective over the past 50 years. From sporadic works in the late 1950s and in the 1960s, it became a systematically analysed topic in the 1970s, starting with pioneering reports and "foundation texts". Our review unfolds the theoretical and empirical evolution of the literature from dyadic interpretations of centralization versus decentralization of R&D by MNEs to more comprehensive frameworks, wherein established MNEs from Advanced Economies still play a pivotal role, but new players and places also emerge in the global generation and diffusion of knowledge. Hence views of R&D internationalization increasingly rely on concepts, ideas and methods from IB and other related disciplines such as industrial organization, international economics and economic geography. Two main findings are highlighted. First, scholarly research pays an increasing attention to the network-like characteristics of international R&D activities. Second, different streams of literature have emphasized the role of location-specific factors in R&D internationalization. The increasing emphasis on these aspects has created new research opportunities in some key areas, including *inter alia*: cross-border knowledge sourcing strategies, changes in the geography of R&D and innovation, and the international fragmentation of production and R&D activities.

Key words: Multinational Enterprises, R&D, Innovation
JEL classifications: F23, L22, O33

INTRODUCTION

This review aims to provide a critical summary of changing views of the internationalization of R&D[1] and innovation, and to identify possible avenues for future research. We will rely on some of the earliest contributions in the field as a starting point, and review subsequent developments in the literature.

To illustrate the evolution of this broad and variegated literature, we identify three distinct phases of theoretical and empirical research on cross-border R&D and innovation activities, although characterized by some non-linear developments and overlaps. While a few studies had already documented the presence of

Multinational Enterprises' (MNEs) R&D activities in some host countries in the 1950s and 1960s[2], the first systematic attempts to understand decentralised R&D in MNEs appeared in the early 1970s. The seminal empirical research conducted by Ronstadt (1978) and Behrman and Fischer (1980a, 1980b) reflected the classic view of horizontally-integrated MNEs largely innovating in the home country and merely adapting product and process technology in the host locations (Vernon, 1966; Caves, 1982). In this phase, which roughly spans from the early 1970s to the mid-1980s, empirical studies of the determinants of R&D Foreign Direct Investment (FDI) were mostly based on surveys and qualitative case histories, with a few notable exceptions represented by cross-section econometric studies mainly based on US Department of Commerce data, broken down by host-country and/or industry.

The second phase began to emerge in the mid-1980s, reflecting the recognition that MNEs were becoming much more strategically complex and diverse, identified as "heterarchy" (Hedlund, 1986) or as "transnational" (Bartlett and Ghoshal, 1989). This phase is characterized *inter alia* by an increasing perception of the diffusion of *home-base augmenting* and *asset–seeking* strategies as opposed to *home-base exploiting* and *asset-exploiting* R&D activities. Such strategies co-evolve with national and regional patterns of knowledge accumulation, and contribute to shaping technological specialization, product-technology life cycles and R&D localization choices, and become a significant component of the innovative capacity of MNEs.

The third, post- 2000, phase is, by and large, characterized by the co-existence and partial convergence of complementary disciplines, including economic geography, international trade and industrial organization, and by the proliferation of empirical works. The latter exploit the increasing availability of longitudinal firm-level data, and of more extensive and detailed surveys and case studies. Established MNEs from advanced countries still play a key role in more recent views of R&D internationalization, but they are placed in the more comprehensive context of the changing organization of international production, wherein new players and places are involved, including MNEs from Emerging areas of the world and relations with actors outside the boundaries of the MNE.

It is worth anticipating two important findings that emerge from this review. On the one hand, we will show that scholarly research pays an increasing attention to the network-like characteristics of international R&D activities. This implies a fundamental shift from a standard model of MNEs centralizing most R&D at the home-country level, towards a more complex multi-centric view of R&D generation, exploitation and diffusion of knowledge involving a variety of actors both within and across the boundaries of MNEs. On the other hand, we will illustrate how different streams of literature have emphasized the role of location-specific factors in R&D internationalization. The increasing emphasis on these factors has created new research opportunities in some key areas that are highly relevant for R&D internationalization, including *inter alia*: cross-border knowledge sourcing strategies, changes in the geography of R&D and innovation, the international fragmentation of production and R&D activities. As we shall discuss in detail how both of these research lines – the network-like evolution of international R&D and the role played by locational factors in cross-border innovation - contributed to important changes in the way R&D internationalization has been

conceptualized and measured; and to the co-evolution and cross-contamination between the literature on R&D internationalization and other related disciplinary approaches.

In the rest of this paper we first provide the intellectual background and motivation to this article, we anticipate the research questions that guided our review work, and explain the methodology we followed. Then we illustrate the pioneering studies on the internationalization of R&D and highlight some of the earliest insights on the variety of strategies that were already starting to emerge in the 1970s and early 1980s. We thereafter account for the proliferation of R&D internationalization literature in the 1990s, with specific reference to different taxonomies of MNEs' cross-border R&D activities, to the literature on the changing organization of internationalization of innovation, and to the studies on locational factors, on entry modes and on National System of Innovation (NSI). Finally, we review the more recent developments in the largely empirical literature after the turn of the 21st century. The focus here is on the numerous attempts to measure and quantify asset-exploiting, asset-seeking and asset- augmenting R&D FDIs; on international R&D networking; and on the changing locational patterns of R&D internationalization. In the concluding section we discuss further research avenues.

BACKGROUND, RESEARCH QUESTIONS AND METHODOLOGY

Background

The texts (Hymer, 1960/76; Vernon, 1966; Dunning, 1977) that we now see as providing the foundations of what became international business (IB) essentially addressed the issue of how and why purely national firms became international. Within this context, the key question was what gave these *proto-multinationals* the ability to do something that was already understood to have a distinctive dimension of difficulty: overcoming the *liability of foreignness* (Hymer, 1960/76; Zaheer, 1995; Zaheer, 2015). Entering an alien economy characterised by intrinsic institutional differences would in fact impose adjustment costs and risks not faced by incumbent local enterprises. The answer, articulated in somewhat different ways in these foundation texts, was that internationalising firms would need some source of unique original competitive advantage not possessed by the competitors they would meet in overseas operations: a "superior technology" (Hymer, 1960), "ownership advantages" (OA) (Dunning, 1977) or "firm-specific advantages" (FSA) (Rugman, 1981). The presumption then was that these advantages were created in the firm's 'home' country and reflected the inventive capacities and market conditions of these economies.

Quite quickly the analytical focus in IB moved from how firms *became* MNEs to how they *behaved* as MNEs. Initially, the first insights that addressed the increasingly influential *why* issue was that these firms internationalised to pursue the continued exploitation of their home-country-sourced competitive advantages. Market seeking (MS) and/or efficiency seeking (ES) subsidiaries (Behrman, 1984; Dunning, 2000; Dunning & Lundan, 2008a; Papanastassiou & Pearce, 2009; Pearce, 2017) were activated to secure appropriate

combinations of local conditions (market or input potentials) and the firms' OA/FSA (Rugman & Verbeke, 2001). However, as we shall see, the increasing attention to the competitive potentials associated with locational factors, paved the way to a gradual extension of the analysis to a larger variety of IB strategies, including knowledge sourcing and competence creating objectives (Dunning & Narula, 1995; Cantwell & Mudambi, 2005; Dunning 2009; Bartlett & Beamish, 2018).

The literature on internationalization of R&D and innovation reflects this gradual and comprehensive change in perspective. In the 1960s and 1970s IB studies largely viewed R&D and innovation as concentrated in MNEs' home countries, with limited involvement of foreign affiliates in the adaptation of extant technologies to local markets. This view largely corresponds to the state of affairs at that time. Moreover, in spite of a remarkable increase in the internationalization of R&D that has been documented over the subsequent decades (UNCTAD, 2005; OECD, 2007, 2011; Dachs, Stehrer, & Zahradnik 2014; Dachs, 2017), a strong *home bias* has historically characterised and still characterises R&D and innovation activities (Patel & Pavitt, 1991; Belderbos, Leten & Suzuki, 2013) conditioned to a large extent by the type of data used and empirical analysis applied[3]. However, international R&D activities have always exhibited a high heterogeneity across countries, industries and, even more so, across firms; and this is true in both quantitative and qualitative terms. The premises for a deeper role of foreign units of MNEs in innovative activities, and in the absorption and creation of valuable knowledge, were already present in the early stages of multinational expansion (Ietto-Gillies, 2019). Some studies in the 1970s had started to pay attention to the different mandates of subsidiaries in the internationalization of R&D as well as to the existence of various types of overseas R&D laboratories, whose activities went well beyond the mere application and adaptation of extant technology. These seminal contributions opened up a rich stream of research on asset-exploiting, asset-seeking and asset-augmenting strategies, which has proliferated in the 1990s and has given rise to an extensive empirical literature, especially at the turn of the new century, when detailed and longitudinal data on R&D internationalization have become available. While asset-seeking and knowledge-creating FDIs may not represent the majority of cases, as we shall see there is evidence of their growing importance in some sectors, and the attention to the emergence of such R&D internationalization strategies has certainly increased in the literature (Belderbos, Sleuwaegen, Somers & De Backer, 2016). Accounts on different international R&D strategies intertwine with developments in the literature on the changing organization of MNEs, particularly with the emergence of new heterarchical and networked structures; and with studies on locational factors affecting the nature and direction of international business activities. Hence works on cross-border R&D and innovation inevitably connect on the one hand with organizational theorising and, on the other hand, with a wide range of contributions on National (and Regional) Systems of Innovation (SI), on the international fragmentation of value- added activities and on the geography of innovation.

Research Questions

Our review work accounts for these changes in perspectives on the internationalization of R&D. As we shall show, such changes are inextricably connected both with the evolution of the phenomenon under

observation, and with a profound transformation in the way authors have been looking at the phenomenon itself.

To explore this broad, heterogeneous and evolving field of study, the review aims to answer the following research questions (RQs).

RQ1: *How do changing views of R&D internationalization combine with the availability of new data-sources and empirical findings?*

Answering this question is of paramount importance when dealing with a relatively new, emerging, hardly documented phenomenon, as was the case of R&D internationalization when IB was born as a discipline. In fact, as R&D FDIs were rare events, no standard methods could be applied to measure them, and extant analytical frameworks could not be used nor easily adapted to interpret them. As we shall show in detail, R&D internationalization has progressively imposed itself to the attention of scholars and has entered their research agenda, inducing them to improve their understanding of it; and new theorising has spurred to search for more comprehensive and convincing evidence. This cumulative process of continuous interaction between empirical and theoretical advancements, often observed in the appearance and consolidation of new scientific paradigms, also generated some conflicting trends in the literature. On the one hand, the availability of more extensive and longitudinal data-sources allowed to shed more and more light on several aspects of the internationalization of R&D that could not even be seen nor explored when scholars first looked at this phenomenon. On the other hand, the increasing availability of richer and more comprehensive data have led researchers to often erroneously assume that complex international R&D operations are a very recent phenomenon. This reflects a lack of historical perspective in much of the recent scholarly research. In fact, as we shall show, seminal contributions of the 1970s had already analysed a variety of R&D laboratories typologies and of cross-border innovation activities, and had documented their co-location with other MNE functions, hence highlighting that R&D internationalization already was a "complex" phenomenon at the time. Table 1 highlights changes in available data-sources and in core themes addressed in the literature in the three historical phases of its evolution.

RQ2: *How did the literature on R&D internationalization incorporate contributions from different disciplines?*

This research question strictly connects to the line of argument we have sketched above. What we wish to explore here is how perspectives on R&D internationalization are themselves affected by, and contribute to, changing views of international production. Reviewing the literature on R&D internationalization, we will have to deal with different aspects IB studies but also, and increasingly, with other more or less related disciplines, including International Trade, Economic Geography, Organization Science, Economics of Innovation and Industrial Organization, and even some research streams that largely lay beyond the scope of this review work like Development Economics and R&D management. These different disciplines have "contaminated" each-other, shedding new light on different aspects of R&D internationalization. The co-evolution and cross-fertilization among different disciplines can be observed in three research areas in

particular. First, developments in Organization Studies in combination with evolutionary approaches to the Economics of Innovation have led IB scholars to pay an increasing attention to the ways in which MNEs organise themselves into complex cross-border *networks*, involving a larger number of innovation units active in the exploitation and exploration of technological opportunities, both within and beyond corporate boundaries. Second, studies on Innovation Systems and more recent advancements in Economic Geography have stimulated more in-depth analyses of the role of locational factors and agglomeration economies, at the national and subnational levels, in attracting R&D FDIs; and on the impact of R&D internationalization in shaping global value chains. Third, contaminations between International Trade and IB literature have led to a reconsideration of *distance factors* in R&D internationalization. Geographic separation appears to play a less significant role when knowledge transfer and absorption is at stake, and this has implications for both public policies and managerial strategies.

Our reading of the extensive literature on R&D internationalization will help us answer these two research questions. Throughout this review, we will highlight how different streams of contributions have shed light on these issues, and will return to them in the concluding section. We will then pull together the various threads we will unravel while exploring the three phases that have characterised the evolution of the field: the pioneering phase of the early 1970s and 1980s, the consolidation phase of the mid 1980s and 1990s, and the more recent wave of interdisciplinary and predominantly empirical research, after the turn of the century.

Methodology

A variety of methodologies have been applied to studies of internationalization processes. Widely used methods include: content analysis which heavily depends on the coding principle adopted to capture qualitative and quantitative dimensions of the area investigated (Duriau, Reger & Pfarrer, 2007; Aykol, Palihawadana & Leonidou, 2013; Gaur & Kumar, 2018); meta-analysis, aiming to produce a quantitative estimate of contributions to extant literature (Welch & Bjorkman, 2015: 305; Buckley, Devinney & Tang, 2013; Meyer & Sinani, 2009); a narrative or critical review aiming at developing or evaluating theories or providing the 'historical account of the development of theory and research on a particular topic' (Baumeister & Leary, 1997: 312; Martinez-Noya & Narula, 2017; Cantwell, 2017); citation or bibliometric analysis as a meta-analytical technique aiming to "analyse the relations between and among articles of a given research area" (Alon, Anderson, Munim, & Ho, 2018: 578; Chabowski, Samiee, & Hult, 2013); the Antecedents-Decisions-Outcome (ADO) approach based on the identification in the literature of the explanatory factors and effects of specific facts or objects of observation (Hitt, Tihanyi, Miller, & Connelly, 2006; Paul & Benito, 2018); and the Delphi Method relying on a systematic collection of views of qualified experts (Liang & Parkhe, 1997).

The choice of methodological tools reflects the different purposes that can be pursued when reviewing extant literature (Welch & Bjorkman, 2015). Moreover, the level of sophistication and complexity of procedures adopted in the selection of relevant literature, and in elaborating views drawn from it, is in turn affected by the richness of approaches and of information sources that need to be examined (Nippa & Reuer, 2019: 3). This is particularly the case when reviewing the literature on R&D internationalization which, as said, relies

on contributions from a wide range of disciplines and calls for a large variety of information sources. As our aim is to evaluate existing conceptual and empirical studies through a historical account of different streams of literature on R&D internationalization, and to ultimately suggest future avenues of research, in this paper we adopt the narrative or critical review methodology. Adopting such a method implies an effort, largely guided by the reviewer's theoretical priors, to deliver the authors' point of view about the 'phenomenon under discussion' (Webster & Watson, 2002: xiv; Welch & Bjorkman, 2015). As in Keupp and Gassmann (2009) and Alon, Anderson, Munim & Ho (2018), we defined a precise point of departure, which in our case is represented by pioneering reports of the US Tariff Commission (1973) and The Conference Board by Creamer (1976) as well as the "foundation texts" of Ronstadt (1978) and Behrman and Fischer (1980a, 1980b). We then identified subsequent streams of literature that differentiate themselves from these seminal works in terms of the key themes, data-sources and/or empirical issues that they emphasize. Consistently with this methodology, and following Welch and Bjorkman (2015) and Paul, Parthasarathy and Gupta (2017), this led us to tentatively distinguish the three phases of theoretical and empirical analysis which we will discuss in the next sections of this paper

Based on this general methodological approach, we carried out a systematic search of relevant literature. Here too, we found inspiration in previous review works (Pearce, 1989; Gassmann & von Zedtwitz, 1999; Zanfei, 2000; Kim, Morse & Zingales, 2006; Cantwell, 2017; Freeman, 2019). Some reviews focus on a small number of academic journals, usually the leading ones in a particular subject, while others provide a more extensive textual coverage (Chabowski, Samiee & Hult, 2013). Similarly, some reviews analyse more circumscribed periods of time whilst others have a more extended timespan (Griffith, Cavusgil & Xu, 2008; Nippa & Reuer, 2019; Paul, Parthasarathy & Gupta, 2017). Our purpose in this review was neither to 'produc(e) mind-numbing lists of citations and findings that resemble a phone book--impressive cast, lots of numbers, but not much plot' (Bem, 1995: 173) nor to focus on selected top journals only, as this would restrict the coverage of relevant sources (Webster & Watson, 2002). We rather decided to select relevant literature according to a three-step procedure.

We first selected the works playing a pivotal role as "focal points" in the study of R&D internationalization, according to our own experience of the field. Our selection has been driven primarily by our own theoretical lenses and understanding of IB literatures on MNE R&D internationalization, to start with, also embracing insights and conceptualizations from complementary streams of literature. This preliminary screening based on our priors brought us to identify what we considered as works marking key points of departure and/or leading to fundamental changes in the way R&D internationalization has been viewed over time. As recommended by Webster & Watson (2002: xvi) we double checked the results of this choice of key authors by adopting a "go backward" approach. Hence, we retrieved the citations of seminal articles per chronological period in order to "determine prior articles" that could be included in the review. This "snow-ball" approach also secured the inclusion of influential books and reports (Martin, 2012).

As a second step, based on the preliminary identification of focal contributions we defined a tentative periodization in evolution of the literature, which eventually led us to identify three broadly sketched phases

characterized by different combinations of research themes and placing different emphasis on specific objects of observation and data-sources. We used this tentative periodization to selectively organize further search of relevant literature with the aim to enrich the coverage of themes, concepts, data-sources and empirical findings, and eventually refine the periodization itself.

Our third step consisted in complementing the results of the preliminary stages of selection of the literature by means of Boolean search of pre-determined keywords or phrases using standard bibliographic databases. Selected keywords included inter alia: "R&D internationalization"; "R&D decentralization"; "overseas R&D"; "Cross-border R&D". These were used both in isolation and in combination with other key words as: "Multinationals/MNEs/MNCs"; "FDIs"; "Globalization"; "Offshoring"; "Knowledge/technology transfer". Like in other review articles addressing multi-dimensional concepts that have evolved overtime it becomes almost impossible to narrow down literature reviews on few clearly defined keywords (Nippa & Reuer, 2019). Thus, the choice of keywords reflects the evolution of our understanding the subject through time. We conducted our search through: Google Scholar, Business Source Complete and Science Direct. We found Google Scholar as the most useful one as it included practically all top- ranking journals whilst it allowed access to reports and papers that could not be traced elsewhere (Nippa & Reuer, 2019). We analysed the results of our Google Scholar keyword search through the Publish or Perish software (Harzing, 2007). The software allows for the classification of results based on a series of factors including among others, number of citations per paper, authors, date of publication, Google Scholar Rank (which indicates most relevant query results). An overview of the analysis of keyword search, the steps followed, and outcomes are presented in Appendix I.

On the one hand, this third step allowed us to confirm that many of the focal contribution we had identified in the previous steps were also among the most cited and recognized over time. On the other hand, it allowed us to further expand the coverage of the literature that needed to be reviewed as a result of the expanding boundaries of research on this theme. Hence this step of the review procedure has induced us to partially reconsider the previous steps, inducing us to identify some additional focal contributions and to further refine our understanding of emerging themes and findings in the literature. See Figure 1 for a summary of the three steps of the iterative search procedure we have followed.

About here:

Figure 1: Methodological steps followed in the review procedure

This procedure led us to what we deemed to be a proper balance between *concept* and *author* centric approaches (Cantwell, 2017; Welch & Bjorkman, 2015; Weber & Watson, 2002). Selected authors are thus associated to key research themes, and main data-sources which have been under the spot light in the different historical phases, as shown in Table 1. This table illustrates the way we will organize the discussion of the extensive literature throughout the three phases of its evolution in time. The subsequent sections of the

paper will focus on each of the three parts of this matrix table and discuss how the literature on the internationalization of R&D has addressed the key themes and used the different data-sources recalled in the table. The contributions listed in the table, in correspondence with each of the examined phases, are not exhaustive of all scholarly work on the topic. However, they represent quite precisely the core results of the selection procedure we have described in this methodological section.

About here:

Table 1 – The evolution in time of the literature on R&D internationalization.

THE FIRST PHASE OF R&D INTERNATIONALIZATION. THE EARLY YEARS

Within the widening scope of IB, as a conscious academic interest, two pioneering works opened the way to the systematic analysis of MNEs' overseas R&D.

The first of these studies was the wide-ranging report of the US Tariff Commission (1973) on the implications for the US economy of its MNEs, which presented and analysed US Department of Commerce data on the extent of overseas R&D in these firms. Taken along with subsequent regular publication of the Department of Commerce data[4] this revealed how the ratio of 'overseas R&D expenditure by US firms as a proportion of their total R&D budgets' varied considerably between industries and through time.[5]

The second of these early studies was conducted by Creamer (1976). Based on US Department of Commerce data, he highlighted that in 1966, 86% of Fortune 500 US companies had foreign R&D expenditure, though the phenomenon did not spread far beyond them, since they accounted for 97% of all overseas R&D expenditure reported by US-based enterprises[6] Moreover, by reviewing detailed data on a sample of 75 leading US MNEs and of their foreign affiliates in 1973, Creamer (1976) found substantial differences in behaviours observed at home and overseas, suggesting that these US MNEs activated foreign units to address specific perspectives and objectives.

We consider these two reports as a starting point in the study of the internationalization of R&D because they both demonstrated the presence of a phenomenon that needed to be analysed, and provided the data sets from which it proved possible to do so.

Indeed, the new evidence on this relatively new and unexplored phenomenon was partially in contrast with IB modelling of the time. Vernon (1966), Kindleberger (1969) and Stopford and Wells (1972) theorised a quasi-colonial relationship between the parent company and foreign subsidiaries, wherein the latter are in

charge of replicating the former's activities abroad, with strategic decisions—including R&D and innovation strategies—being rigidly centralised.

Data illustrated in these pioneering studies would rather appear to suggest a more complex view according to which R&D location decisions resulted from tensions between 'centripetal and centrifugal forces' (Hirschey & Caves 1981: 11). While centripetal tensions derived from the need to exploit economies of scale in R&D, control strategic information and minimise knowledge leakages, it was recognised that some decentralization of R&D might be due to the MS need to adapt products and processes to subsidiaries' host markets (Mansfield & Romeo, 1980). Accordingly, several studies eventually emphasised that the level of overseas sales/production was a positive determinant of the propensity to implement subsidiary-level R&D (Lall, 1979; Mansfield, Teece & Romeo, 1979; Hirschey & Caves, 1981; Håkanson, 1981; Mansfield & Romeo, 1984; Pearce, 1989: 60-7, 71-89).

Consistent with, and often anticipating, models of centripetal and centrifugal tensions within MNEs, empirical studies in the 1970s and early 1980s did suggest that foreign subsidiaries might pursue a variety of objectives, to enhance the MNE' s overall performance.

The most advanced and anticipatory studies conducted along these lines are the ones by Ronstadt (1977) and by Behrman and Fischer (1980a, 1980b) who identified the connection between R&D internationalization and subsidiaries' roles strategic diversification.

Ronstadt (1977) surveyed the overseas R&D experience of seven US-based MNEs, securing information on the positioning and evolution of 55 such units. The centrepiece of his analysis was the clear delineation of different roles that such laboratories could play[7]. He does not see these laboratory roles as fixed or immutable. A key perception is that they can evolve along with the needs and capacities of an associated subsidiary, reflecting the development of its host economy and of the progress and expectations of the parent MNE.

The study of Behrman and Fischer (1980a, 1980b) provides yet another pioneering and perhaps more systematic attempt to relate the presence and roles of overseas R&D units of 50 US and European MNEs to their broad strategic formulation and ambitions. Their findings are illustrative of at least two facts that will draw the attention of subsequent research. On the one hand, the presence of overseas R&D units was at the time relatively limited, even more circumscribed than today, at least by comparison with the host-market subsidiary MNEs. On the other hand, when present, "world-market" MNE laboratories, i.e. those playing specialised roles in centrally coordinated supply chains, were by far the most likely to include 'new product research' and 'exploratory research'.

To sum up, conceptualizations and empirical findings from this early phase are indicative of emerging strategic diversity in R&D internationalization, even in the late 1970s. The fact that many of these MNE subsidiaries operated without institutionalised R&D suggests the predominance market- and/or efficiency - seeking subsidiaries, producing mature goods of the group using accepted and standardised technologies

(aligned with Vernon's standardised product phase). However, the presence of some subsidiaries with clear commitments to innovation-oriented laboratories may provide an early sighting of MNEs' technology sourcing strategies that have then come later under the spotlight in international business literature.

THE CONSOLIDATION IN MNE R&D INTERNATIONALIZATION: THE 1980S AND 1990S

While the 1970s and the early 1980s have witnessed the emergence of internationalization of R&D as a relatively new and largely unexplored topic in IB, it is in the mid-1980s and 1990s that studies in this field reach their maturity (Wortmann, 1990; Dunning, 1992; Pearce 1989; Pearce & Singh, 1992; Cantwell, 1989, 1995; Zejan, 1990; Kumar, 1996; Niosi, 1999). Howells (1989) explicitly observes that a transition was taking place from "*locational rigidity*" towards the "*locational/spatial fluidity*" of R&D functions[8].

Niosi (1999) in his introduction, as the guest editor, of a Research Policy Special Issue on *The Internationalization of Industrial R&D*, provided a detailed overview of the empirical and theoretical trends governing the internationalization of R&D until the late 1990s[9]. He argued: "*the internationalization of R&D is slowly but surely moving past the transfer to the periphery of technology developed close to headquarters, and (...) at least the most advanced multinational corporations of all industrial nations are now trying to absorb externally-developed science and technology*." In a nutshell, Niosi's statement indeed captured a change in perspective that had been taking place over a couple of decades, and seemed to have reached a climax at the time he was writing. We will unravel this change in perspective and will examine how scholars understood the process of internationalization of R&D in the 1980s and 1990s. The focus will be firstly on taxonomies of overseas R&D laboratories and on related organizational restructuring of the MNE; secondly, on the study of "where" and "how" cross-border R&D takes place, hence addressing location specific factors and entry modes.

Overseas R&D Laboratories Taxonomies and MNE Organizational Restructuring

A large number of works on internationalization of R&D in the 1990s engaged in the development of taxonomies. Three types of such taxonomies have emerged in the literature. The first type emphasizes *how the different R&D functions follow distinct locational patterns*. (Håkanson,1981; Howells, 1990a, 1990b; Pearce & Singh, 1992). As von Zedtwitz and Gassmann (2002: 572) stated: 'Differences between research and development in terms of location rationales and work culture effectuate different geographical distribution and concentration in different regional centres'. A second set of taxonomies focuses on the *characteristics and objectives of overseas R&D laboratories* (Håkanson & Nobel, 1993a; Medcof, 1997; Zander, 1999). A third set of taxonomies captures the *links between overseas R&D laboratories and knowledge sourcing*. From this perspective, Cantwell (1995) asserted that technological leaders internationalized their R&D in order to have access to new knowledge and scientific sources (on top of

demand-led motives as postulated by Vernon's (1966) product cycle model). Of great influence was the study by Florida (1997) who linked MNEs' decisions to establish overseas R&D laboratories with supply-side motivations to access new sources of technology whilst Kuemmerle (1997; 1999a) distinguished between *home-base augmenting* (HBA) and *home-base exploiting* (HBE) overseas R&D sites, often used interchangeably with the juxtaposition between *asset exploiting* and *asset seeking* (Dunning & Narula, 1995; Archibugi & Michie, 1995; Odagiri & Yasuda, 1996; Chiesa, 1996; Gassmann & von Zedtwitz, 1999; Pearce & Papanastassiou, 1999).

While taxonomies accounted for the large and increasing variety of R&D internationalization patterns, several studies in the 1980s and 1990s have focused on organizational implications of overseas R&D on MNE structure (Gassmann & von Zedtwizt, 1999). Analyses of the organization of cross-border R&D in this phase appeared to follow two main, largely complementary, research lines.

The first stream of research highlighted that the geographic dispersion of R&D activities undermines the traditional centralized structure of the MNE and pushes towards the development of *international innovation networks* (Granstrand, Håkanson, & Sjölander 1993; Malnight, 1996; De Meyer, 1993; Howells, 1990a, 1995; Chiesa 1996; Zander, 1999; Niosi & Godin, 1999) [10].

The emphasis on innovation networks is quite consistent with a more general view of the MNE as a *heterarchy* as suggested by Hedlund (1986). Hedlund and Rolander (1990: 25-6) note the presence of 'many centres of different kinds' so that there is increasing geographical dispersion of traditional HQ functions, including R&D, and 'no dimension (product, country, function) uniformly super ordinate'. This geographical dispersion augmented the innovative capacity of MNEs via their network of subsidiaries and overseas R&D laboratories.

MNEs were thus increasingly understood to pursue *global innovation strategy* (GIS) through a network of interdependent and differentiated subsidiaries and overseas R&D laboratories.[11] Gupta and Govindarajan (1991; 1994) and Bartlett and Ghoshal (1990) introduced integrated models of innovation processes in MNEs encompassing the interaction and knowledge flows between different types of subsidiaries and HQs. Research by Molero and Buesa (1993), Hood, Young and Lal (1994), Molero, Buesa and Casado (1995), Roth and Morrison (1992), Papanastassiou and Pearce (1997), Forsgren and Pedersen (1998), Pearce (1999b) and Lehrer and Asakawa (2002) provided fresh empirical evidence on how the positioning of R&D in the operations of MNE subsidiaries affected the innovative strategies of MNEs.

Along with analyses of knowledge exchanges and innovation flows within the MNEs, there has also been a growing attention in the 1980s and 1990s to MNEs' involvement in technical linkages with external parties (local firms and institutions, as well as global suppliers, purchasers and competitors) which also play a key role in the development of innovation (OECD, 1986; Pisano, 1990; Dunning 1994; Asakawa, 1996, Andersson & Forsgren, 2000). It then appeared that the internationalization of innovation takes place within a context of a "double-network organization", combining MNE's internal networks of R&D units with

external networks of knowledge intensive relationships with other stakeholders, beyond the boundaries of the MNE (Zanfei, 2000).

The trend towards international networking intertwines with changes in the roles played by foreign R&D affiliates as illustrated and classified in the taxonomies we have recalled earlier. In particular, it has been noted that MNE's global innovation strategy implies that central laboratories act as orchestrators of knowledge across national borders, enabling MNEs 'to tap the full potential of their R&D networks' (Kuemmerle, 1997: 70; Håkanson & Zander, 1988; De Meyer & Mizushima, 1989; Gerybadge & Reger, 1999; Elder, Meyer-Krahmer & Reger, 2002)[12]. This evolution led to a positive upgrading of the subsidiary's mandate (Birkinshaw, 1996), which was then defined as *creative transition* (CT) (Papanastassiou & Pearce, 1994; Pearce, 1999a), to the emergence of dynamic types of subsidiaries (Pearce, 1989; Papanastassiou, 1999), and to the assignment of innovation-oriented 'product mandate' (PM) subsidiaries [13]. In this context, seminal are the works of Poynter and Rugman (1982) and (Rugman & Bennett, 1982; Rugman, 1983; White & Poynter, 1984) as well as Etemad and Seguin Dulude (1986) and Bonin and Perron (1986) on the innovative capabilities of Canadian World Product Mandate (WPM) subsidiaries. As Pearce (1989: 130) noted, WPM subsidiaries generated 'independent innovative capability through the support of their own R&D laboratory'. This transformation of subsidiaries is indeed part of, and consistent with, the overall change of the organizational structure of the MNE itself, which we referred to above as *transnational* (Bartlett & Ghoshal, 1989, 1990; Bartlett and Beamish, 2018) and *heterarchical* (Hedlund, 1986, 1993; Hedlund & Rolander, 1990; Birkinshaw, 1994; Malnight, 1996).

To summarise, the studies we have reviewed bring two issues at central stage. First, these streams of literature highlight the embryonic state of reflections of the time on the organization of R&D internationalization. The proliferation of taxonomies of cross-border R&D activities, reflects the fact that R&D internationalization was a rather fluid and heterogeneous phenomenon, characterized by a high variety and variability in time, as a result of numerous and variegated actors involved both within and across MNEs. Theorizing on R&D networking of 1980s and 1990s constituted an attempt to move a step forward in the direction of designing new models cross-border R&D. However, while some of these models did emphasise R&D networking within MNEs and the development of R&D linkages with external parties, they still disregarded the complementarities between internal and external networks and remained mainly concentrated on the organizational challenges posed by the expansion of MNEs' internal webs of R&D labs. Implications of the double network approach to internationalization of innovation are further discussed in forthcoming sections of this review.

Second, these works appear to share a tension towards overcoming traditional views of the role of MNEs in innovation activities. In other words, most, if not all, of the examined taxonomies as well as the literature that was then growing on the changing organization of the MNE appear to respond to the need to overcome the previously dominant perception that cross-border R&D activities played a purely ancillary role relative to MNEs' home-based technology.

Where and How R&D is Internationalised: The Role of Locational Factors and of Entry Modes

In parallel with the studies on the taxonomies of R&D subsidiaries and on MNE organizational restructuring, in the late 1980s and early 1990s, IB literature has started paying an increasing attention to *where* and *how* cross-border R&D was occurring. This implied on the, one hand, a careful analysis of the interaction between cross-border R&D and locational factors (hence the importance of *where* R&D is located); and, on the other hand, an effort to explore alternative modes of entering, and dealing with, local contexts when knowledge creation and transmission is at stake (hence the importance of *how* R&D enter foreign locations).

In line with the literature on NSI, (Freeman, 1987; Lundvall, 1988, 1992; Nelson 1993), one can envisage a link between *location factors*, the internationalization of R&D and innovative capability of MNEs. On the one hand, dynamic innovation systems attract *knowledge-seeking* (KS) subsidiaries, as these can be expected to benefit from local external economies and knowledge (Dunning & Narula, 1995; Cantwell & Mudambi, 2000). The tacit nature of technology implies that even where knowledge is available through markets (as technology markets generally tend to be under-developed), it still needs to be modified to be efficiently integrated within the acquiring firm's portfolio of competencies. In addition, the tacit nature of knowledge associated with production and innovation activity in these sectors implies that 'physical' or geographical proximity is important for transmitting it (Blanc & Sierra, 1999). While the marginal cost of transmitting codified knowledge across geographic space does not depend on distance, the marginal cost of transmitting tacit knowledge increases with distance. This leads to the clustering of innovation activities, in particular at the early stage of an industry life cycle, where tacit knowledge plays an important role (Audretsch & Feldman, 1996)[14]. On the other hand, MNEs are likely to contribute to the dynamics of NSIs by means of their capacity to transfer valuable knowledge and to generate technological spillovers, which could reinforce local innovation clusters or weaken them (Niosi, Saviotti, Bellon, & Crow, 1993; Freeman, 1995; Patel & Pavitt, 2000; Reddy, 2000; Narula 2003).

It has thus been suggested that the types of MNEs' R&D laboratories have direct and differing implications on host-countries' NSI technological capacity (Pearce & Singh, 1992; Dunning,1992; Chesnais, 1992; Pearce, 1997; Papanastassiou & Pearce; 1999; Kuemmerle, 1999b)[15]. This raises public policy issues concerning: measures to enhance innovative capacity of both home and host countries directly (though investments in the creation of innovatory capabilities) and indirectly (via spill-over effects) (Dunning, 1992; Håkanson & Nobel, 1993a, b; Coe & Helpmann, 1995; Kasteloot & Veugelers, 1995; Kokko, 1998; Narula, 2003[16]), the forces behind the creation of 'technological advantages' and 'technological heritage' of national economies (Mowery & Oxley, 1995; Patel & Vega, 1999; Pearce & Papanastassiou, 1999;), the creation of a complex and multidimensional national policy framework to selectively attract R&D via inward FDIs and collaborative agreements, and to secure positive gains of R&D internationalization for local economies (Granstrand, Håkanson & Sjölander, 1993; Muralidharan & Phatak, 1999), and the challenges of effective policies in an interdependent globalized world (Archibugi & Iammarino, 1999)[17].

Other streams of literature address the "how" issue, hence focusing on the *mode of entry* of foreign R&D in the host-locations. This aspect of R&D internationalization has also received a considerable attention in the 1980s and 1990s, reflecting once again the interaction of empirical and theoretical works. The variety of entry modes adopted by MNEs has been documented, highlighting the important role played by Mergers and Acquisitions (M&A) (Hennart & Park, 1993), by the creation of wholly owned subsidiaries (UNCTAD, 1998), and by international technological alliances (OECD, 1986; Mowery, 1988). This evidence contributed to open a debate on the circumstances that made one strategy more advantageous than another when cross-border location decisions are at stake.

From a transaction costs perspective, entry through wholly owned foreign activity would represent a first best especially in the case of R&D internationalization as it reduces the costs and risks associated to the idiosyncratic nature of knowledge assets (Buckley & Casson, 1976; Teece, 1977). As Kogut and Zander (1993) postulate, highly complex technology leads to the establishment of fully owned subsidiaries. Prior entry can be expected to reduce *external and behavioural (internal) uncertainty* in international operations. (Davidson, 1980; Gomes-Casseres, 1989). Nevertheless, once entry has occurred, there might be different effects in terms of subsequent modes of foreign market penetration, especially when combined with knowledge transactions, given the relatively high uncertainty associated to the management and transmission of knowledge assets (Slangen & Hennart, 2007; Ivarsson & Vahlne, 2002; Belderbos, 2003; von Zedtwitz, 2003) [18].

Other approaches to entry modes pay closer attention to asset-seeking strategies and dynamic efficiency considerations[19]. Consistent with a more general view of complementarity between internal and external competence accumulation (Cohen & Levinthal, 1989; Rosenberg, 1990; Arora & Gambardella, 1994), the establishment and activity of foreign subsidiaries over time can be identified as a fundamental asset that increases a firm's *exploration potential*, hence paving the way to R&D collaborations (Cantwell, 1995; Castellani & Zanfei, 2004). The need for a timely and effective knowledge access may spur firms to choose *strategic alliances* even when short term, static (transaction and organizational) cost minimization would point to different forms of linkages (Teece, 1992; Mowery, Oxley & Silverman, 1996; Narula & Dunning, 1998; Narula & Hagerdoon, 1999; Oxley & Sampson, 2004; Sampson, 2004; Narula & Duysters, 2004).

Empirical research on the choice of entry modes in cross-border R&D in the 1990s reflects the variety of approaches to this issue. Some results unambiguously support the transaction cost view that higher experience favours a higher degree of control over foreign operations (Davidson, 1980; Davidson & McFetridge, 1985; Gomes-Casseres, 1989; Mutinelli & Piscitello, 1998). In a number of cases, the impact of experience variables on the choice of international linkage mode turned out to be more ambiguous (Kogut & Singh, 1988; Gatignon, & Anderson, 1988; Erramilli, 1991; Hennart & Larimo, 1998; Padmanabham & Cho, 1999; Arora & Fosfuri, 2000). There is also sparse evidence on a process where the increasing experience with foreign contexts leads to an increase in mutual trust and a reduction of opportunism (lower internal uncertainty), fostering a cumulative involvement of MNEs in collaborations with local firms (see McAleese & McDonald, 1978; Lall, 1979; Dunning, 1993; Bureth, Wolff & Zanfei, 1997; Sachwald, 1998). Other

works have found evidence in support of the dynamic capability hypothesis, which would envisage a greater role of more flexible and reversible modes of entry such as joint ventures and strategic alliances. From this perspective, several studies provide convincing evidence of a complementarity between MNEs' networks of subsidiaries and the development of technical linkages with foreign partners (See Arora & Gambardella, 1990; Malerba & Torrisi, 1992; Steinmueller, 1992; Ernst, 1997; and Castellani & Zanfei, 2002 for analyses of collaborative entry modes in biotechnology, software, semiconductor, and electronics industries).

To conclude, the streams of literature we have recalled, concerning locational factors and entry modes, address two key and potentially related issues. On the one hand, they highlight that local innovation systems co-evolve with R&D internationalization, hence placing new emphasis on host-country specific factors in attracting R&D FDIs and of R&D FDIs affecting local innovation systems. This paves the way to research on the role locational factors, which will be later carried out at a more fine-grained geographical level, including regions and cities as attractors of R&D FDIs. On the other hand, the literature on entry modes sheds some light on how cross-border R&D can occur in different ways according to the role played by static or dynamic efficiency considerations. This is consistent with subsequent empirical research on asset seeking and asset augmenting which will be at center stage after the turn of the century.

MNES' INTERNATIONALIZATION OF R&D AFTER THE TURN OF THE 21ST CENTURY

Research on R&D internationalization after the turn of the 21st century has been largely characterised by the effort to develop comprehensive interdisciplinary frameworks in understanding cross-border R&D activities as an integrated component of the fine-slicing of MNE production on a global scale. From this perspective, a number of studies have found that the capacity to organise effective networks within and across firms' boundaries is a fundamental asset to exploit in-house technology as well as to enhance access to localized knowledge sources. Depending on disciplines, this emphasis on the fragmentation of production and R&D has been framed alternatively and quite inter-changeably in the contexts of the Global Factory (Buckley & Strange, 2015); of Global Production Networks (GPN) (Ernst & Kim, 2002); of Global Value Chains (GVCs) (Gereffi, 1999; Gereffi, Humphrey & Sturgeon, 2005; Mudambi, 2008; Saliola & Zanfei, 2009; Pietrobelli & Rabellotti, 2011; Kano, 2018, De Marchi, Di Maria & Gereffi, 2018); of Global Innovation Networks (GNI) (Lema, Quadros & Schmitz, 2015); and of R&D offshoring, captive or outsourced (Mol, 2005; Cusmano, L., Mancusi, M.L., & Morrison, A. 2009; Grimpe & Kaiser, 2010; Demirbag & Glaister, 2010; Sartor & Beamish, 2014; Pisani & Ricart, 2018). While there are differences in analytical tools and focus across these ways of conceptualizing R&D internationalization, these streams of literature largely share a strong emphasis on the changing organization of cross-border production and innovation activities, that inevitably spans across individual firms, sectors and product lines, and assign distinctive roles to different players, functions and locations (García-Vega, Hofmann, & Kneller, 2019). Advanced countries

and regions and established MNEs continue to play a key role, but new international actors, clusters and regions are increasingly involved in this global organization of innovation, including emerging countries and EMNEs. Moreover the increasing attention to locational patterns of innovation has led scholars to focus more and more on subnational levels of analysis, with a growing consideration of the role played by regions, cities and metropolitan areas in attracting global players and R&D investors (McCann & Acs, 2011; Santangelo & Castellani, 2017; Tojeiro-Rivero & Moreno, 2019). These ways of conceptualizing the role of cross-border R&D also have connections with the relatively long tradition of studies on MNEs' embeddedness in local contexts (Andersson & Forsgren, 2000; Andersson, Bjorkman & Forsgren, 2005) and with the more recent developments of research on MNEs' "double networks" and "multiple embeddedness", emphasizing the increasing variety of linkages between different knowledge sources within and across corporate boundaries (Castellani & Zanfei, 2006; Meyer, Mudambi & Narula, 2011; Alcácer, Cantwell & Piscitello, 2016). The streams of literature we have briefly recalled triggered research focusing on at least three key aspects of R&D internationalization that are worth examining in details. First, more systematic empirical evidence has been produced on the nature and intensity of cross-border R&D, and on asset-seeking and asset-augmenting strategies in particular. Second, more attention has been given to international R&D networking, with a greater emphasis on MNEs' technical linkages with external parties. Third, changes in the locational patterns of R&D activities have come at centre stage.

New Empirical Evidence on Asset-Seeking and Asset-Augmenting R&D Offshoring

The increasing availability of detailed and longitudinal data has paved the way to more systematic empirical studies on R&D internationalization. MNEs are not only responsible for the largest R&D budgets, but they have also increased significantly the share of R&D and inventive activities carried out outside their home countries over the past two decades, although with substantial differences across countries of origin and destination; and they contribute to a substantial share of local R&D in many host countries and regions (UNCTAD, 2005; OECD, 2007; Dachs, Stehrer & Zahradnik, 2014, Dachs 2017;)[20]. Even more important, empirical research has also been conducted at more disaggregated levels and has yielded valuable evidence on the asset-seeking and asset-augmenting nature of R&D internationalization (Narula & Zanfei, 2005; Blomkvist, Kappen & Zander, 2010).

A path breaking empirical work on motives underlying R&D FDIs is the one conducted at the beginning of the new century by Le Bas and Sierra (2002) on a sample of 345 MNEs with the greatest patenting activity in Europe between 1988 and 1996, which accounted for about half of total patenting through the European Patent Office (EPO). The authors emphasised that MNEs are likely to pursue different motivations in their cross-border innovation according to how their technological profiles compare with those of firms active in host locations. MNEs with high 'Revealed Technological Advantage' (RTA) are likely to exploit advantages created at home, when the host economy has no RTA in the same field (asset exploiting). As opposed to this quite traditional circumstance, MNEs may aim at accessing complementary knowledge assets abroad in two different circumstances. On the one hand, they will be induced to access external knowledge sources when they have some technological weakness (no RTA) as compared to a revealed advantage (high RTA) of local

firms (technology sourcing). On the other hand, when both MNEs and local firms have some revealed advantage in the same technological field, MNEs and local firms may be willing to exchange knowledge on a reciprocal basis (asset augmenting). Le Bas and Sierra (2002) confirmed previous findings by Patel and Vega (1999), that MNEs seldom internationalised their activities to compensate for a technological weakness at home (13% of all observed cases) - hence pure "technology sourcing" turned out to be rare. Much more frequent was what they dubbed as "asset exploiting" (30% of cases). However, what is even more interesting is that the most frequent circumstance was "asset augmenting", when the MNE had a RTA at home in the presence of a RTA of the host economy in the same technology (47% of all cases)[21]. This may indicate the formation of "centres of excellence" in which strong domestic research environments function as attractors of asset augmenting multinational activities. Moreover, the authors showed that this circumstance had become more frequent over the examined period.

While Le Bas and Sierra have the clear merit of highlighting the circumstances that are most likely associated with different R&D FDI strategies, their analysis is subject to two important sources of criticism. First, there is a clear sample bias: the observed importance of asset augmenting strategies might well be due to the fact that they consider firms that are by definition the most innovative firms as they are the top ranking in patenting activities. Second, they only make inference on the likelihood that FDIs generate knowledge flows, but their data do not allow to control for the type of FDIs (whether they are R&D FDIs or not) nor to directly investigate whether and to what extent MNEs are actually sourcing (or augmenting) their knowledge through their foreign R&D activities.

Several studies have tried to fill this gap using patent citation data to evaluate the extent to which foreign based firms relied on local knowledge[22]. Cantwell and Noonan (2002) showed that MNE subsidiaries located in Germany between 1975 and 1995 sourced a relatively high proportion of knowledge (especially new, edge-cutting technology) from this host country. Altogether these data lend support to the idea that foreign owned technological activities undertaken in Germany are often asset-augmenting. Using US Patent and Trademark Office (USPTO) patents granted to over 4,000 MNEs from six countries (US, Japan, Germany, France, UK and Canada) over the period 1986-1995, Singh (2004) highlighted that foreign subsidiaries cited host-country patents more often than did home-country inventors. However, this pattern appeared to vary significantly across countries and sectors, depending on the knowledge- intensity of FDI. Criscuolo, Narula and Verspagen (2005) focus on a large number of recipient countries and obtained less straightforward evidence. Using both USPTO and EPO citations the authors found that US affiliates in the EU relied mainly on home-region knowledge sources, while EU affiliates in the US, especially when they had an R&D mandate, had a relatively higher propensity to cite patents granted in the host country.

Technology sourcing and asset augmenting strategies have also been detected by estimating the effects of R&D FDIs on MNEs' innovation performance. Nieto and Rodriguez (2011) use the Spanish Technological Innovation Panel in which firm innovation (detected by a dichotomous variable that takes the value 1 if the firm engages in any product or process innovation) is estimated as function of R&D offshoring (which is a dichotomous variable that assumes the value 1 if the firm acquired R&D services abroad, therefore both

captive and outsourcing), and a set of controls. From over twelve thousand firms in 2004–2007, they find a positive relation between firm innovation and R&D offshoring; such relation is stronger for product than for process innovation, being the latter based more on tacit knowledge. De Beule and Van Beveren (2019) use Community Innovation Survey data for Belgium to investigate the role of external knowledge sources on foreign affiliates' research efforts and innovation and distinguish between different types of subsidiaries, in order to disentangle differences in the use of knowledge sources between technology exploiting, seeking and creating subsidiaries. They find that technology-creating foreign affiliates are able to tap into a combination of industry-based value chain partners and science-based partners. Technology-seeking subsidiaries make more use of collaboration with competitors. Technology exploiting subsidiaries make significantly less use of external knowledge sources and have a lower R&D intensity.

More indirect measures of technology sourcing and asset augmenting strategies are based on productivity data, used to detect the effects of R&D FDIs on the performance of firms investing in advanced countries (Driffield & Love, 2004; Griffith, Harrison & Van Reenen, 2006); to evaluate how R&D offshoring in emerging countries affect the knowledge basis at home (Piscitello & Santangelo, 2010); and to estimate EU regional performance as a function of R&D offshoring (Castellani & Pieri, 2013).

Based on this overview, one may tentatively conclude that the increasing availability of longitudinal micro - level data has allowed scholars to obtain detailed evidence on the links between FDIs, innovation and productivity, which appears to be broadly consistent with the asset seeking/knowledge augmenting hypothesis. As compared with previous studies, which were characterised by a greater use of surveys, case studies and of cross-section sectoral data, these more recent works can rely on longer series of data to illustrate that R&D internationalization has indeed increased in intensity, and that in some circumstances R&D FDIs are associated with improvements in firm performances over time. In addition, the longitudinal nature of datasets allows to better control the direction of causality and to highlight some of the circumstances under which cross-border R&D can actually affect firm performance. However, these studies still have a limited capacity to support the often alleged view that R&D internationalization is mainly or largely an asset seeking/knowledge augmenting activity. On the one hand, they are mostly circumscribed to a few countries and sets of sectors, hence their results can hardly be generalised. Moreover, they provide indirect evidence of the actual motivations underlying R&D investment decisions. This calls for more comprehensive analyses that mix quantitative with more qualitative methods to explore the mechanisms that are conducive to the absorption and accumulation of knowledge through cross-border R&D.

MNEs' International R&D Networking

Attention to networking in the organization of MNEs' innovative activities has been significantly growing since the late 1990s and early 2000s, and partly intertwines with the theoretical and empirical research on asset-seeking and asset-augmenting motives for R&D internationalization which we have accounted for. From this perspective, it has been increasingly acknowledged in the literature that the combination of traditional asset-exploiting objectives with increasing asset-seeking/asset-augmenting activities entails a transition of multinationals towards a *double network structure* (Zanfei, 2000; Castellani & Zanfei, 2006).

On one hand, MNEs are more and more characterised by the interconnection of a large number of internal units that are deeply involved in the company's use, generation and absorption of knowledge (Bergek & Bruzelius, 2010; Narula, 2017). On the other hand, units belonging to the internal network tend to develop external networks with other firms and institutions that are located outside the boundaries of the MNE, in order to increase the potential for use, generation and absorption of knowledge (Ivarsson, 2002; Ivarsson & Jonsson, 2003; Narula & Duysters, 2004; Santangelo, Meyer & Jindra, 2016; Chen, Zhang & Fu, 2019). The development of external networks is thus largely complementary to the growth of multinationals through internal networks (Castellani & Zanfei 2006; Phene &Tallman, 2018; De Beule & Van Beveren, 2019)[23]. In a similar vein, Cantwell (2017) explains how the process of organizational MNE structure involves inter-unit differentiation and the development of international innovation networks evolving around internal and external knowledge exchange (see also Alcácer, Cantwell & Piscitello, 2016).

Indeed, most of the literature on *competence-creating* activities by MNE subunits has stressed the importance of being *embedded* in local business networks and in national or regional innovation systems of a host country (Cantwell & Mudambi, 2005; Savona & Schiattarella, 2005; Forsgren, Holm, & Johanson, 2005). A crucial issue in this respect is how *local embededdness* increases reliance on host context specific-knowledge sources (Frost, 2001), with possible lock-in effects (Narula, 2003), and often changes the nature, direction and intensity of MNEs' R&D (Håkanson & Kappen, 2016). Frenz and Ietto- Gillies (2009) use two waves of Community Innovation Survey (CIS) data for the UK to show that the international dimension of internal networks heavily affects firms' innovative performance, while interactions between the own-generated knowledge and external sources increase the innovation potential of enterprises. Recent work by Blomkvist, Kappen and Zander (2018) relate the technological interactions among multinational units (between "sister' subsidiaries, and between subsidiaries and HQs) with the mode of entry. They conclude that greenfield subsidiaries are better technologically integrated within the MNE as compared to acquired ones.

Moreover, a growing literature has documented that MNEs tend to be deeply embedded in multiple locations, enabling them to leverage tangible and intangible resources across national borders (Collinson & Wang, 2012; Figueiredo, 2011). As suggested by Meyer, Mudambi and Narula, (2011: 236) this concept must be analysed at two levels. At the MNE level, *multiple embeddedness* implies the need to interact with a larger number of heterogeneous contexts, in each of which the firm has to place its roots. Hence, MNEs can be expected to significantly differ in terms of their abilities to manage complex portfolios of assets across different locations, and to extract economic value out of them (Achcaoucaou, Miravitlles, & León-Darder, 2014). At the subsidiary level, multiple embeddedness reflects the need to reconcile possibly conflicting tensions. On the one hand, subsidiaries are forced to be responsive to local pressures deriving from the contexts where they are active; on the other hand they must comply with the rules of corporate governance leading to the integration of individual affiliates within the multinational corporation (Asakawa & Aoki, 2016; Ciabuschi, Forsgren, & Martín, 2017; Asakawa, Park, Song, & Kim, 2018). From this perspective, Santangelo, Meyer and Jindra (2016) and Martinez- Noya and Garcia-Canal, (2018) pointed out that the

decision of a subsidiary to outsource its R&D activities heavily depends, inter alia, on the quality of local sub-national institutions, while Pisani and Ricart (2018) emphasise the role of national institutions.

The actual propensity of MNEs to develop external R&D networks has been questioned in several empirical studies. Veugelers (1997) finds that foreign firms do not exhibit any higher propensity to set up R&D linkages with local firms as compared to national firms. In Belderbos, Carree, Diederen, Lokshin, and Veugelers (2004: 1256), 'foreign multinationals were found to have a lower propensity to engage in horizontal cooperation, but were not less inclined to cooperate vertically or with universities and research institutes'. However, when they restrict their analysis to R&D cooperation with local partners, they find a strong negative impact for multinational firms. The negative impact of foreign ownership on R&D cooperation with local firms has been found also by Veugelers and Cassiman (2004, 2005) for Belgium, Knell and Srholec (2005) for the Czech Republic. In partial contrast with evidence referring to other countries, Holl and Rama (2014) and García Sánchez, Molero and Rama (2016) find that belonging to a foreign MNE active in Spain increases the probability to cooperate in innovation locally, at least vis-à-vis unaffiliated local firms. Guimòn and Salazar-Elena (2015) assess the probability of subsidiaries of foreign MNEs to cooperate with local universities. They find 'that foreign subsidiaries exhibit a lower propensity to collaborate with Spanish universities than local group firms, while both collectives collaborate more often with universities than unaffiliated local firms' (2015: 451).

Using RS1 data from the Italian National Bureau of Statistics (ISTAT) combined with Bureau van Dijk data, Cozza, Perani and Zanfei (2018) distinguish foreign MNEs from domestic owned MNEs active in Italy and find that the former exhibit no premia in terms of R&D cooperation as compared to non MNEs, while domestic MNEs do outperform other firms in this respect. They suggest that this is revealing that while *multinationality* is associated the usual advantages in terms of R&D intensity, *foreignness* also entails a "liability" that translates into higher costs and risks when undertaking transactions and setting up technical linkages with local counterparts (see discussion on multinationality and foreignness in Higón and Antolin, 2012; Miotti and Sachwald, 2003; and Srhrolec, 2009, 2015)[24].

To summarise, two important developments seem to emerge from this review of the recent literature on R&D networking. First, while attention to either internal networking and to the MNE's embeddedness in nexuses of local relationships is quite well rooted in IB literature, what appears to be indeed new in more recent research is the complementarity between internal and external networking. It is by combining multiple relationships within and across firm boundaries that MNEs can leverage upon a variety of knowledge sources. This is a key aspect of the cross-border organization of R&D which is still under-explored and calls for greater consideration. Second, there is rather conclusive evidence that while foreign MNEs do develop linkages with local firms they are more prone to cooperate with "international" partners, signalling that they are probably better at exploiting their global networks of innovation.

Changes in the Locational Patterns of MNEs' R&D Activities

Patterns of geographical location of R&D FDIs have received a particular attention over the past two decades. This has been partially the result of the increasing convergence of economic geography and international business studies (see Castellani, 2018, for a recent review). Economic geographers have emphasized that innovation is spatially concentrated, and knowledge spillovers are geographically localized (Feldman & Kogler, 2010). In fact, innovation activities tend to cluster in order to take advantage of locally available knowledge (Gertler, 2003; Bathelt, Malberg & Maskell, 2004; Balland, Boschma, & Frenken, 2015). Building on the Marshallian concept of "atmosphere", Storper and Venables (2004) have characterised this cumulative process of geographic clustering of innovation as the result of "local buzz", that is the localised capacity of people and firms present in the same industry, place and region to communicate and transmit sticky, non-articulated, tacit forms of knowledge

On the other hand, virtually no region can be completely self-sufficient, and isolated clusters and districts are likely to be less dynamic than globally connected ones (Gertler, 2008; see Turkina &Van Assche, 2018 and Esposito & Rigby, 2019, for studies on cluster global connectedness). From this perspective, agglomeration forces may not yield efficient outcomes, to the extent that path dependencies prevail and localised patterns of technical change are pursued creating barriers to the "contaminating" effect of external investors. Myles Shaver and Flyer (2000) pointed towards firm heterogeneity in location decision making. Similarly, Mudambi and Santangelo (2016) show that MNE subsidiaries in less competitive regions may exhibit dismal performances and it is the gradual evolution of their mandates that can determine the growth path of less competitive regions or countries. On a different level of analysis, Schotter and Beamish (2013) discussed the impact of the *hassle factor* on individual managers which eventually puts them off from particular locations.

Thus, the changing geography of innovation is the result of tensions between forces leading towards concentration of R&D in specific clusters and forces leading clusters to create connections with external sources of knowledge. Three such forces will be discussed below in detail: agglomeration economies and factors inducing firms to co-locate R&D activities; gravitational forces, and distance factors in particular, affecting R&D location decisions; and locational factors affecting R&D FDIs in (and from) Emerging and Developing Countries (EDCs).

Agglomeration economies, co-location and the changing geography of innovation.

External agglomeration economies have been traditionally identified with relational and communication advantages associated with the co-presence of firms in the same industry (Marshall, 1920); and with inter-industry spillovers generated by co-presence of firms operating in diversified contexts (Jacobs, 1969) (see Beaudry and Schiffauerova (2009) and Andersson, Larsson, and Wernberg (2017) for recent accounts on the role of agglomeration economies in economic behaviour and performance). An extensive body of empirical research has documented that *external agglomeration economies* may significantly affect MNEs' location decisions. On the one hand, MNEs often adopt a risk averse approach by locating their subsidiaries in regional clusters. Hence, they are likely to choose destination countries, regions and cities associated with

low information costs and requiring that limited sunk costs are undertaken to make business feasible, thus limiting the risk of irreversible losses in case of wrong location choices (Mariotti & Piscitello, 1995; Henisz & Delios, 2001). On the other hand, MNEs are particularly interested in clusters that facilitate specialization and diversification economies, advanced infrastructures, global connectivity and networking (McCann & Acs, 2011).

Castellani and Santangelo (2017) have highlighted that external agglomeration factors may differ according to the global value chain activities. This reflects the original insights of Hymer's concerning the impact of MNEs' 'functional expansion on the developmental stratification of the global economy (Pearce & Papanastassiou, 2006: 153; Hymer & Resnick, 1971; Hymer, 1972) Recent works have highlighted that the availability of highly qualified human capital and, in the case of complex technologies requiring large size laboratory equipment and plants, even land costs may be crucial in R&D location decisions (Athukorala, & Kohpaiboon, 2010; Siedschlag, Smith, Turcu, & Zhang, 2013; Iversen et al., 2017). The congestion costs of global cities or metropolitan areas may be detrimental in the case of R&D location decisions, while these cities and areas may instead be attractive in the case of HQs and support services, which are more interested in infrastructural and connectivity aspects. Thus, cross-border R&D activities would be attracted in cities, which are not at the top of the spatial hierarchy and are less congested, but are lively cultural hubs with a long university tradition, and offer availability of highly skilled labour and space (Castellani & Santangelo, 2017). This finding is also consistent with qualitative evidence, as in the case of Astra Zeneca innovation activities in China (Zhao, Tan, Papanastassiou & Harzing, 2019).

Crescenzi, Dyevre, and Neffke (2018) have shown that MNEs' R&D location decisions have significantly affected the international patterns of patenting activities in 1975-2012 by contributing to the spatial concentration of R&D and innovation activities in the areas where they place their plants; and indirectly by attracting further R&D labs set up by other local and foreign investors. This confirms the cumulative concentration effects, reinforced by the widespread adoption of an imitative behaviour by local and foreign peers), likewise motivated by the need to reduce information costs and uncertainty (Lieberman & Asaba, 2006; Vicente & Suire, 2007, Lavoratori, Mariotti & Piscitello, 2017).

Since the turn of the century, an increasing attention has been devoted also to the role of *internal agglomeration economies* and to intra-firm co-location phenomena i.e. to MNEs' search of geographical proximity with their activities previously located in the foreign country.

Intra-firm co-location allows the cross-border sharing of physical assets (plant and machinery), specialised people, teams, logistic and support services for geographically concentrated units (Alcácer & Delgado, 2016; Stallkamp, Pinkham, Schotter, & Buchel, 2018), as well as economies of scale and scope in other activities, such as procurement and branding (Rawley & Seamans, 2014). Co-location decisions may also pursue network economies to reduce information costs that may be negatively associated with the number of users within the MNEs, as shown by Chang and Park (2005) with reference to Korean companies with subsidiaries

in China, whilst recent work by Ivarsson, Alvstam and Vahlne (2017) shows co-location of product development within overseas manufacturing facilities of leading Swedish MNEs[25].

Some scholars observe that the effects of co-location (or proximity) vary in relation to the different phases of the value chain mainly due to their different need for control and coordination, and to the codified nature and asymmetries of the information involved) (Alcácer & Delgado, 2016; Gray Siemsen, & Vasudeva 2015; Davids & Frenken, 2018; Schubert, Baier & Rammer, 2018; Mudambi, Narula & Santangelo, 2018).

Proximity and co-location also helps reduce distance-sensitive costs of monitoring/controlling and coordinating complementary activities between MNEs' units (Mariani, 2002; Ketokivi & Ali-Yrkkö, 2009; Gray, Siemsen & Vasudeva, 2015); and facilitate the sharing of experience, information and tacit knowledge between different functional units of the enterprise, with a positive impact on productivity (Tecu, 2013; Adams & Jaffe, 1996). Ivarsson, Alvstam and Vahlne (2017) find that co-location between R&D and production is crucial in new product development for the global and regional markets, especially in engineering-intensive industries (see for similar conclusions Buciuni & Finotto, 2016; Belderbos, Sleuwaegen, Somers & De Backer, 2016; Castellani & Lavoratori, 2019)[26].

An important complement to physical co-location is the development of virtual teams on a global scale as a means to coordinate and manage international innovative activities (Townsend, DeMarie, & Hendrickson, 1998; McDounough III, Kahn, & Barczaka, 2001; Powell, White, Koput, & Owen-Smith, 2005; Hertel, Geister, & Konradt, 2005; Castellano, Davidson & Khelladi, 2017), and to overcome the constraints and challenges of knowledge sharing (Gupta & Govindarajan, 1991)[27]. Cummings and Teng (2003) found that virtual R&D teams can benefit from substantial reductions of idle times by combining the activities of researchers located in different countries (and time zones). Moreover, asynchronous communication between separate research units can also be associated with some advantages as it favours a more comprehensive development and assimilation of ideas (Allen, 1977; Ale Ebrahim, Ahmed, & Taha, 2010)). Particularly in the context of New Product Development (NPD), information and communication technologies have facilitated the set-up of virtual teams as a way to effectively organise the internationalization of innovation (von Zedtwitz & Gassmann, 2002, Gassmann & von Zedtwitz, 2003; Cantwell, 2017; Péréa & von Zedtwitz, 2018). Thus, co-location stops being a prerequisite in retaining talent, since "locational anchors for many important technologies are becoming geographically dispersed across the globe" (Cummings &Tend, 2003: 59). In line with this argument, work by Blomkvist, Kappen and Zander (2014), puts emphasis on the role of individual inventors within MNEs as generators of technological advancements, adopting a people-centric approach to innovation. Many of these "star inventors" do not wish to relocate and are found to be location bound. Consequently, virtual collaborative networks determine their innovative interactions and performance.

Research has shown that the success of virtual and global NPD teams faces challenges that are quite similar to those faced by physical co-location, and depends on the interdependencies of various factors including: how these teams are managed, the degree of creativity of the project at stake, the quality of enabling

technology, mutual trust (see Gassmann and von Zedtwitz (2003) for a review of the literature on key factors affecting the management of virtual R&D teams; Ale Ebrahim, Ahmed & Taha, 2010; Huang, 2009; Kratzer, Leenders, & Van Engelen, 2006).

Finally, as a theoretical bridge between co-location and virtual teams, several authors have proposed the notion of "temporary proximity" (Torre & Rallet, 2005; Gertler, 2008; Torre, 2008; Crone, 2012), i.e. the idea that actors need not be in constant geographical proximity, as meetings, short visits and temporary co-location may suffice to develop other forms of proximity (e.g., organizational), which enable collaboration over large geographical distances. This might particularly apply to service activities (including R&D) which tend to be relatively mobile, largely immaterial, and embodied in modular bundles of specialized and relational-dedicated human resources (e.g., staffs of professionals and consultants), thus reducing the need for permanent physical proximity (Crone, 2012; Mariotti, Mutinelli, Nicolini & Piscitello, 2014). To conclude, as argued by Mc Dounough III, Kahn, and Barczaka (2001) and Gassmann and von Zedtwitz (2003), the choice between permanent or temporary co-location, virtual and/or global organization of MNE R&D embraces different managerial issues and coordination challenges and can hardly lead to general good-for-all rules, leaving ample room to a case by case evaluations (Katz & Allen, 1983; Manolopoulos, Söderquist, & Pearce 2011; Zeschky, Daiber, Widenmayer, & Gassmann, 2014).

Distance factors and R&D FDI location decisions.

While geographic separation does not seem to play an impeding role in setting-up virtual and global teams (Cummings &Teng, 2003; Ambos & Schlegelmilch, 2004; Péréa & von Zadtwitz, 2018) there has been, since the turn of the century, an increasing attention to the specific impact of distance factors in R&D FDI decisions (Ambos & Håkanson, 2014). The issue at stake here is the extent to which distance is as good a predictor of the dispersion of R&D and innovation facilities, as it appears to be the case for trade and for FDIs in production activities. In other words, given the highly clustered nature of R&D and innovation activities which we have discussed earlier, the key question arises: 'How far are MNEs willing to go with their R&D in order to be close to knowledge cluster?'

International trade literature has assigned a pivotal role to geographic distance as a "catch-all" variable underlying different barriers to economic transactions.[28] Relatively recent literature has concentrated its attention on two aspects of distance that are particularly relevant for R&D FDI decisions.

First, the multidimensional nature of distance factors has come at center stage, and the specific role of cultural and social barriers to international transaction – as distinguished from geographic distance - has been explicitly acknowledged and dealt with in both theoretical and empirical research. Empirical works in international business have extensively used proxies based on Hofstede's (1980) dimensions of national culture (namely: masculinity, individualism, power distance and uncertainty avoidance) as a key additional dimension of distance[29]. Other more recent studies have increasingly emphasized differences in languages, religious attitudes, legal systems, levels of industrial development, regulatory and trade regimes, travel and living inconveniences, as key factors inhibiting international exchanges and FDIs (Shenkar, 2001;

Ghemawhat, 2001; Evans & Mavondo, 2002; Dow & Karunaratna, 2006; Dunning & Lundan, 2008a, 2008b; Berry, Guillen & Zhou, 2010; Schotter & Beamish, 2013), especially when knowledge intensive transactions are at stake (Castellani, Jimenez & Zanfei, 2013; Ghemawat 2016). Also, a number of contributions in international trade have explicitly taken into account the specific role of cultural and social barriers to international trade that should be analytically distinguished from geographic distance (Frankel & Rose, 2002; Casella & Rauch, 2003; Huang, 2007; Guiso, Sapienza & Zingales, 2009). The term "institutional distance" appears to be comprehensive enough to include such non- geographical distance factors , identifying transnational differences in terms of formal and informal rules, incentive structures, enforcement mechanisms, and voluntary behavioral initiatives which will ultimately affect firms choices (Dunning, 2009: 24) in a co-evolutionary framework (Cantwell, Dunning & Lundan, 2010 ; Dunning & Lundan, 2008b; Child, 2009).[30]

The second aspect that has come under the spot in recent research is that the mix of barriers and connectors varies according to the transnational activity that is being considered, including R&D FDI. The impact of individual components of distance has been found to be different according to the nature of goods/sectors involved (Ghemawat, 2001), to the characteristics and motivations of investing firms (Nachum & Zaheer, 2005), to market seeking (horizontal) vs. efficiency seeking (vertical) FDI (Slangen & Beugelsdijk, 2010), and to the characteristics of affiliates in foreign markets (Berry, Guillen & Zhou, 2010; OECD, 2011), and of MNEs in general (Ghemawat, 2016).

Dunning (2009) has stressed that, as knowledge spreads across national boundaries, greater attention should be given to the location of different parts of the value chain of the MNE, and of R&D in particular. He places this view in the context of a comprehensive reconsideration of the concept of distance: along with the costs of traversing physical distance, firms face the costs of dealing with different corporate and national institutional regimes, and the latter costs play a greater role in the case of knowledge intensive industries. These institutional costs can be particularly high when transferring assets from advanced to developing economies and vice-versa. Recent work by Narula (2017) discusses the implications of distance within the MNE in the sustainable development of FSAs in the context of EMNEs.

While it is generally acknowledged that distance is potentially damaging to knowledge relationships, as it may create barriers to communication and mutual understanding between the parties involved (Goodall & Roberts, 2003), a few have explored the different mechanisms available to manage international knowledge transfer (Martin & Salomon, 2003) and have addressed the issue of how these are themselves influenced by distance factors (Doz & Santos, 1997; Ambos & Ambos, 2009). From this perspective, it has been argued that technology-based coordination mechanisms are relatively insensitive of spatial distance (Ghemawat & De La Mata, 2015), while personal coordination mechanisms relying on interactions between individuals are harmed by all aspects of institutional distance (Higon & Antolin, 2012), and by cultural and linguistic distance in particular (Ambos & Ambos, 2009).

Ambos and Ambos (2011) claim that the uncertainty associated with explorations, along with the high risk involved in dispersing strategically important resources abroad, lowers the likelihood of setting up a knowledge-seeking laboratory in a culturally distant country as opposed to a knowledge exploiting investment.

Using EPO data for the 2000-2005 period, Dachs and Pyka (2010) find that geographic distance between the inventor's country of origin and the country of application is negatively correlated to the number of foreign patents obtained, while language commonality positively affects cross-border inventive activity. Picci (2010) instead uses a broader range of indicators of cultural and social proximity along with more traditional measures of geographical distance and language commonality as determinants of international patenting activities. He finds that geographic distance has a negative effect on bilateral knowledge transfers across countries, while other measures of cultural and social proximity exert a positive and significant effect. Picci (2010) thus implicitly recognizes the multifaceted nature of distance.

Using data on R&D and manufacturing investments of 6,320 firms in 59 countries, Castellani, Jimenez & Zanfei (2013) find that geographic distance has a lower negative impact on the probability of setting up R&D than manufacturing plants.

With reference to city level location decisions, Castellani (2017) obtains similar results and confirms that MNEs may need to travel long distances to tap into knowledge intensive clusters.

R&D FDIs in (and from) emerging and developing countries.

A key feature of locational patterns of innovative activities is the increasing role of EDCs especially as receivers of R&D FDIs (UNCTAD, 2005; D'Agostino, 2015). In 2003–2012, top host emerging markets (i.e. China, India, Singapore, Taiwan, Israel, Brazil, Malaysia, and Russia) received 45 % of world R&D FDI; top home advanced countries (i.e. US, Germany, Japan, France and UK) accounted for 70.1 % of world R&D FDI (Castelli & Castellani, 2013). In non-traditional markets (i.e. Singapore, Israel, Ireland, China, Hong Kong, Mexico, Brazil, Malaysia, Taiwan, and South Korea), foreign R&D by US MNEs has grown rapidly: it was 11 % of R&D expenditures of US foreign affiliates in 1994, and 18 % in 2000 with an average annual rate of 15.9 %, as compared with a 6.9 % increase for all host countries (Dunning & Lundan, 2009).

It has been observed that this trend is related to a general growth of FDIs in these countries (Lewin & Couto, 2006), as well as to R&D-specific location advantages, such as large pools of science and engineering talents (Manning, Massini & Lewin, 2008), wage differentials (Demirbag & Glaister, 2010), and the upgrading of local technological capabilities (Gassmann & Han, 2004; Liu & White, 2001). R&D laboratories are often set up in low-income economies to support local sales and production, while R&D FDI into advanced countries are usually determined by the need to access new or complementary knowledge (Von Zedtwitz, 2004). More recent evidence corroborates this view, but also suggests that emerging countries might also be chosen to tap into location specific advantages (Demirbag & Glaister, 2010; Shimizutani & Todo, 2008). Lewin, Massini and Peeters, (2009) apply a co-evolutionary framework to explain how the pursuit of pools

of talents leads to MNE innovation offshoring (captive and outsourced), whilst recent research by Awate and Mudambi (2018) on the global wind power industry shows that developing economies are becoming hotbeds for innovative activity that leads to patent generation.

Over the past two decades, the debate has oscillated around two alternative hypotheses, each supported by largely inconclusive evidence. On the one hand, the 'Reverse Knowledge Transfer (RKT)-based division of labor' hypothesis, which states that emerging countries are chosen for low-value R&D, while advanced countries are suitable for high-value R&D (Demirbag & Glaister, 2010; Govindarajandjian & Ramamurti, 2011). From this perspective, home countries of MNEs – which are most frequently advanced economies – are likely to have nothing to lose from R&D FDIs towards EDCs. In fact, R&D carried out in EDCs will generally involve technology that does not substitute for the one developed at home. Moreover, in case R&D performed in EDCs leads to valuable knowledge, it is most likely that it will be transferred back to the HQs, to ensure a greater economic exploitation it.

On the other hand, the 'hollowing-out' hypothesis dates back to Kotabe (1990) and suggests that an increase of R&D activities in emerging countries might substitute R&D carried out in advanced countries, that HQs might lose control over dispersed R&D and that obstacles for an effective RKT might arise, as some of these difficulties are more severe in emerging countries (Sartor & Beamish 2014). Among other factors, it is argued that an effective RKT may be hampered by particularly high cultural and institutional distances, such as different codes of conduct and Intellectual Property Rights (IPR) regimes (Xie & Li, 2018; Rosenbusch, Gusenbauer, Hatak, Fink, & Meyer, 2019).

After reviewing extant literature on this topic, D'Agostino (2015) concludes that the majority of studies she considered concurs that R&D offshoring in emerging countries does not bear a hollowing-out of innovation capacities at home. However, the evidence suggests that the positive or negative effects of R&D offshoring to developing are likely to depend on the geographical distribution of technological activities (Piscitello & Santangelo, 2010); on the type of R&D activities (D'Agostino & Santangelo, 2012); on the type of technology (Castellani & Pieri, 2013); and on the nature of subsidiaries being created in host locations, with RKT more likely to occur when subsidiaries are competence creating and technology is of interest to the parent company (Yang, Mudambi & Meyer, 2018). As observed for FDIs in general, R&D offshoring in developing countries is likely to be beneficial to firm innovation up to a certain degree of international dispersion, while too much offshoring might lead to difficulties in control and supervision (Kotabe, Parente & Murray, 2007; Mihalache, Jansen, Van Den Bosch & Volberda, 2012). Recent work by von Zedtwitz, Corsi, Søberg, and Frega (2015) departs from Govindarajan and Ramamurti (2011) and goes beyond the traditional view of reverse technology transfer by providing an integrated model of *reverse innovation flow.* They define the latter 'as any type of global innovation that, at some stage, is characterized by a reversal of the flow of innovation from a developing to an advanced country, as long as this innovation is eventually introduced to an advanced country's market' (2015:3). Hence innovation may be transferred also at an initial stage of idea generation, when the new technology has not been developed nor commercialized yet. This allows for a broader range of reverse knowledge transfer, including circumstances in which MNE

subsidiaries in developing and emerging economies source knowledge locally and thereafter generate innovations that can be potentially launched globally (Zhang & Pearce, 2010; Zhao, Tan, Papanastassiou & Harzing, 2019; Jha, Dhanaraj, & Krishnan, 2018; von Zedtwitz & Gassmann, 2016; Huang & Li, 2019).

While R&D FDIs from advanced economies towards EDCs have attracted a relatively large number of studies, the role of EMNEs in the internationalization of R&D has received a lower albeit growing attention in some recent works (Minin, Zhang & Gammeltoft, 2012). He et al., (2017) confirm the disruptive nature of leading EMNEs in the global innovation scene. Awate, Larsen and Mudambi (2015) compare R&D strategies of AMNEs and EMNEs in the wind power industry and conclude that asset-exploitation and asset-augmenting arguments apply in both cases. On the other hand, EMNEs rely mostly on the overseas R&D in advanced economies to compensate for the lack of knowledge in HQs and thus to succeed in innovation catch up. Similarly, Elia and Santangelo (2017) showed that EMNEs respond to global competition through strategic-asset seeking in advanced countries NSIs. This is in line with previous findings on the asset-augmenting strategies of EMNEs (Kedia, Gaffney & Clampit, 2015; Giuliani, Gorgoni, Günther & Rabellotti, 2014; Fu, Xiu & Liu, 2018) whilst recent research by Wang, Xie, Li and Liu (2018) on Chinese MNEs concludes that overseas subsidiaries pursue both asset exploiting and augmenting strategies with the latter being encouraged by a high number of low cost R&D personnel. Furthermore, Li, Strange, Ning and Sutherland (2016) not only confirm the importance of asset-augmenting strategies of Chinese MNEs but also show the beneficial impact of their overseas R&D on the home country innovative activities. A similar conclusion is reached by De Beule and Somers (2017) who find a strong positive impact of Indian MNEs knowledge-seeking overseas investments in advanced economies on home R&D.

In summarizing, research on MNE R&D internationalization after the turn of the 21st century cements the need for comprehensive interdisciplinary frameworks as well as a variety of empirical data in order to capture the evolving complexity of the phenomenon. Asset-augmenting innovation strategies place renewed emphasis on location and distance with co-location playing a major role on where and how to set up R&D operations. At the same time distance seems to play a less significant role in R&D internationalization as offshoring is in this case less subject to standard transportation costs and uncertainty factors are more related to institutional diversity than to geographical separation. Moreover, the use of digital technologies appears to facilitate virtual collaborative environments, largely unaffected by distance, especially when codified knowledge transfer and processing are at stake. In all cases however, what is becoming evident is that R&D internationalization is a strong component of MNE innovation strategies. This is particularly evident in the case of EMNEs who are pursuing knowledge-seeking FDIs overseas whilst MNEs from advanced economies, source new knowledge assets (including lower cost, high quality researchers) from emerging economies' newly organised NSIs (Liu & White, 2001; Lundvall, Johnson, Andersen, & Dalum, 2002; Álvarez & Marín, 2010).

CONCLUSIONS

The paper has reviewed an extensive literature on MNEs' internationalization of R&D that has thrived over the past 50 years.

Reviewing such a broad range of contributions was a challenge on its own. We aimed at producing an integrative paper, embracing key strands of the literature that have analysed R&D internationalization from different perspectives and separate intellectual silos. By doing so, we tried to create a common platform of dialogue that connects various disciplines, taking into account their underlying assumptions and methodologies, and critically highlighting changes in perspectives and possible inconsistencies. However, as Martin (2012) acknowledges, no matter what approach is adopted, in identifying the relevant literature, "gaps" may still exist in the coverage of scholarly research due to the different starting points and selection criteria (Kim, Morse & Zingales, 2006) as well as author bias (Nippa & Reuer, 2019). At any rate, our effort was to critically discuss the main conceptual and empirical issues raised by various streams of literature, originating from different disciplines, to offer a rich account of the past and ongoing research on this topic.

Our work gravitated around two key research questions (anticipated in the Background, Research Questions and Methodology section). Let us briefly outline the answers to these questions which can be found in our reading of the literature.

About here:

Table 2. Responding to RQ1: *How do changing views of R&D internationalization combine with the availability of new data-sources and empirical findings?*

With regard to the **first research question** (*How do changing views of R&D internationalization combine with the availability of new data-sources and empirical findings?*) we found several examples of cumulative interaction between empirical and theoretical advancements which have indeed shaped the literature on R&D internationalization (see Table 2 for an illustration of the conceptual issues emerged in the three phases we have examined, combined with measurement and empirical issues). The reader should also refer to Table 1 for details on data-sources that have played a major role in each historical phase.

As discussed in previous sections, the dominant view in the 1960s and 70s was that R&D and innovation needed to be largely centralised in the MNEs' home countries implied that the then relatively few experiences of R&D internationalization were scarcely documented if not disregarded. Limited systematic data (mainly based on the US BEA statistics), *ad hoc* surveys and case studies helped shed some light on this phenomenon in the early phases in which it was studied. It is worth highlighting three important conceptual developments that have occurred in combination with the increasing availability of data and richer information on R&D internationalization.

First, while the importance of centripetal forces is still widely recognised, there has been a gradual understanding of the growing role of foreign units in the absorption, development and transfer of knowledge. Based on the insights put forth in some empirical works of the 1970s, a number of studies proliferated in the 1990s and have analysed the variety of roles played by overseas R&D laboratories and subsidiaries in the management and development of technology. The pursuit of different international business objectives has come at centre stage, including traditional market seeking and efficiency seeking but also, and more significantly, asset-seeking and asset-augmenting strategies. In the early phases of research on this topic, these views were accompanied by largely impressionistic and mostly indirect evidence, which however caught important signals that R&D internationalization might be an important source of ex-post technological advantages.

Second, over the past two decades empirical studies have yielded a rather abundant evidence consistent with the idea that firms do source valuable knowledge abroad. While pure technology sourcing aimed to compensate specific weaknesses of MNEs in given fields is not so widespread as a practice, access to foreign knowledge tends to be frequent and increasing, especially in contexts where both MNEs and local firms have some technological advantage. Under the latter circumstances, knowledge exchanges are likely to occur on a reciprocity basis, giving rise to R&D FDIs that pursue asset augmenting objectives. MNEs cite local knowledge in their foreign patenting activity, R&D offshoring is associated with improvements in product and process technology, and with better performances. There is also evidence of MNEs' HQs and foreign subsidiaries bargaining for competence creating mandates. As shown, these facts are by now well documented in the case of firms originating from, and investing in, advanced countries (mainly the US and the EU) and in some sectors (mainly in high tech industries and in science- based sectors in particular). Fresh evidence also exists concerning asset exploiting as well as asset seeking and asset augmenting R&D FDIs involving EDCs, both as recipient and as host locations of cross-border innovation.

Nevertheless, apart from a few notable exceptions, empirical studies seldom provide a comprehensive picture of the relative importance of different cross-border R&D strategies. Even more so, comparative studies across countries of origin and destination of investors and across sectors are still lacking.

More generally speaking, a broader picture is largely missing of how R&D internationalization co-evolves with more general forces of change at the macro and meso level. There is plenty of room for systematic empirical research in this respect.

One should also stress that there is no evidence that more traditional asset-exploiting strategies have disappeared, nor that different R&D internationalization motives substitute one another. There is instead sparse but rather convincing evidence that different R&D strategies co-exist, and are likely to continue to do so. This is clearly reflected in the diversity of roles performed by the overseas R&D units and is captured by various typologies. One can expect a significant heterogeneity in this respect both between and within sectors. Furthermore, diversities in the combination of asset-exploiting, asset-seeking and asset-augmenting strategies are likely to be observed also within firms, as these will be different in terms of their portfolio of competencies. Foreign MNEs can also expected to be placed quite differently as compared to local counterparts, in terms of knowledge assets needed to compete in their different lines of business. At this

point we should stress that while recent availability of data at the functional level has allowed more detailed and comparable analyses of intensity and geographical distribution of R&D internationalization, the characteristics of cross-border R&D activities appear to be much less considered in recent literature, which instead were at center stage in studies first conducted in the 1970s and in taxonomies in the 1980s and 1990s cemented in their analysis. From this perspective, the earlier studies included in this review should not be viewed merely as outdated or of some historical interest, but as cornerstone knowledge which will allow researchers to reassess the current theoretical contributions as per our discussion below.

Third, the increasing availability of longitudinal data-bases at the national, regional and sub-regional levels, and at the sectoral, firm and functional levels, including official trade and FDI statistics, innovation and patent data as well as commercial databases, has allowed to explore causal relations between R&D FDIs and economic performance, and of the changing geography of innovation. Once again, the reader should refer to Table 1 for details on the richness of data that have become available in this respect over the past two decades. Richer and more comprehensive data-sources have made it possible to overcome the limitations of analyses of technological spillovers of R&D FDIs on host economies which had long been based either on case studies or on cross-section econometric studies at the sectoral level. Firm level, longitudinal data on international R&D operations combined with micro-data on economic performance of companies and regions have shed new light on the (relatively few) circumstances that make it possible for technology transfer to occur within and across industries. New data on FDIs at the functional level and on co-patenting activities of firms, detailed at the subnational level of geographic disaggregation, have also allowed to explore changes in location and co-location patterns of R&D and innovation, and to provide evidence on the fine slicing of Global Value Chains.

An important caveat applies here. On the one hand, the availability of more detailed evidence allowed to shed more light on several aspects of the internationalization of R&D that could not even be seen nor explored when scholars first looked at this phenomenon. On the other hand, the increasing amount and quality of data have led some researchers to believe that relatively complex and geographically distributed cross-border R&D activities were a new phenomenon. As we have argued, the latter erroneous perception indeed reflects a lack of historical perspective in much of the recent scholarly research, which our paper attempts to overcome.

About here:

Table 3: Responding to RQ2: *How did the literature on R&D internationalization incorporate contributions from different disciplines?*

With regard to the **second research question** (*How did the literature on R&D internationalization incorporate contributions from different disciplines?)* we can conclude that different strands of literature have contributed to, and have been affected by, changes in perspective in R&D internationalization (see Table 3 for a synthetic illustration of the increasing convergence of different disciplinary approaches that appear to have occurred in the analysis of R&D internationalization over the past decades.

To start with, the literature on cross-border R&D strategies intertwines with innovation studies, starting from the early theorizing of MNEs as characterised by superior technology and ex ante ownership advantages. Evolutionary views of economic change have affected subsequent research on R&D internationalization by providing important insights that have been subsumed in IB views of role of R&D and technological accumulation in international production.

R&D internationalization literature also combines quite effectively with organizational studies. Such connections have emerged quite early in the literature on the decentralization of R&D decisions within MNEs. These organizational changes proceed hand in hand with the international dispersion of innovative activities and with the development of extensive innovation networks both within MNEs and across MNEs' boundaries, which have received more recent attention in IB. The other side of the coin is the governance of internal and external generation, absorption and transmission of knowledge. Important connections have emerged here with transaction cost economics and with studies on the management of dynamic capabilities, although the latter can be more easily used to interpret choices in R&D internationalization. Key, increasingly explored, areas concern the ownership structure of entry modes, the characteristics of incentives, communication channels, learning procedures and cohesion mechanisms that allow MNEs to extract economic value from the growing geographic dispersion of their R&D activities.

Furthermore, there are connections between the literature on R&D internationalization, studies on innovation systems and works on the geography of innovation, with important contacts with economic development research. R&D localization and co-location patterns are influenced by the structure and behaviour of institutions and by technological opportunities characterising the home and host locations in which MNEs are active. A growing literature has documented the role of MNEs in contributing through their FDIs to the cumulative processes of geographic concentration of innovation. However, there are also signals that they also transfer valuable knowledge from one cluster to another, and favour the emergence of new innovation clusters. Moreover, in some circumstances, R&D FDIs have generated technological spillovers fostering the economic performance of local firms and creating upgrading opportunities for emerging economies.

These trends have been only partially documented, and there is need for future research on the role of MNEs in shaping the geography of innovation. While established MNEs from advanced countries continue to maintain a fundamental role in patterns of R&D internationalization, new players and places are increasingly involved in global production and R&D networks. These include EMNEs and other internationalised firms and institutions from both advanced and emerging countries as well as sub-national regions, that are active in R&D, often in connection with one another and with established MNEs. The relative positions of these different actors within such networks, the nature of opportunities created for development, and the implications for the global organization of production and R&D are still largely unexplored.

Another stream of literature interwoven with contributions on R&D internationalization refers to the role of distance factors. Both international trade and international business studies have shown that MNEs' internationalization of R&D is not as hindered by geographic distance as FDIs in manufacturing and other business activities are. Indeed, firms may need to cover long distances to get as close as possible to the key

centers of generation of knowledge. Moreover, in order to attain a global reach in R&D activities, the relevant costs are not so much those of traversing physical distance, but rather those of dealing with institutional barriers to effective communication. Recent research has shown that barriers (and enablers) to knowledge transfer do not lay only between national borders, but also involve differences across groups of nations and, even more so, among cities and regions belonging to different countries. This increasing evidence should encourage further interdisciplinary research among development, regional, and IB scholars. Institutional and cultural barriers may also significantly differ according to the level of industrialization of the areas of origin and destination of investors. This distinction might be particularly relevant in consideration of the fact that important R&D centers are increasingly located in EDCs.

This set of issues poses complex challenges to MNEs, which will have to make remarkable efforts to monitor centers of excellence all over the world, to select qualified scientists, engineers and managers on a global scale, and to organize their international mobility and/or to favour their virtual networking. National governments also need to undertake non-trivial efforts to upgrade the content and quality of innovation systems, of intellectual property rights and more generally aimed at the reduction of institutional distance with respect to key knowledge-sourcing locations. Fact-finding qualitative and quantitative studies are badly needed in this respect. There is a high need to explore the nature of such institutional factors and their impact in the development of international knowledge flows and "pipelines", and to provide sound foundations for national and supranational policies in this domain.

A personal note from the authors. Robert (Bob) Pearce, one of the co-authors of this review work, passed away during the period we submitted the paper. Bob was one of the pioneers who shaped the study of MNE R&D internationalization and gave a very valuable and unreplaceable contribution to our understanding of the field. We are feel confident that he would have agreed to the conclusions of this paper. With regard to his insights for avenues of future work, he would have also encouraged research to investigate how MNEs' operations contribute to growth and development (Pearce, 2017) whilst his last (unfinished) work focused on emerging MNEs and economies and "how the decentralised/internationalised processes of innovation have been organised and operationalised as a practice within individual MNEs but more in terms of how the spread of innovation by MNEs, *per se*, diffused and expanded geographically through time" (Pearce, unpublished notes). We hope that this review sets the foundations for well-informed future research of a topic that pioneers like Bob Pearce brought into life and continues to intrigue and fascinate academics and practitioners.

REFERENCES

Achcaoucaou, F., Miravitlles, P., & León-Darder, F. 2014. Knowledge sharing and subsidiary R&D mandate development: A matter of dual embeddedness. *International Business Review*, 23(1): 76-90.

Adams, J., & Jaffe, A.B. 1996. Bounding the effects of R&D: an investigation using matched establishment-firm data. *RAND Journal of Economics*, 27(4): 700–721.

Ahammad, M.F., Konwa,r Z, Papageorgiadis, N., & Wang Wang, C. 2018. R&D capabilities, intellectual property strength and choice of equity ownership in cross-border acquisitions: Evidence from BRICS acquirers in Europe. *R&D Management*, 48(2): 177-194.

Alcácer, J., Cantwell, J., & Piscitello L. 2016. Internationalization in the information age: A new era for places, firms, and international business networks? *Journal of International Business Studies*, 47(5): 499–512.

Alcácer, J., & Delgado, M. 2016. Spatial organization of firms and location choices through the value chain. *Management Science*, 62(11): 3213–3234.

Ale Ebrahim, N., Ahmed, S., & Taha, Z. 2009. Virtual teams: A literature review. *Australian Journal of Basic and Applied Sciences*, 3(3): 2653-2669.

Allen, T. J. 1977. *Managing the flow of technology: Technology transfer and the dissemination of technological information within the R & D organization*. Cambridge, Mass.: MIT Press.

Almeida P. 1996. Knowledge sourcing by foreign multinationals: patent citation analysis in the semiconductor industry. *Strategic Management Journal*, 17(S2): 155-165.

Alon, I., Anderson, J., Munim, Z. H., & Ho, A. 2018. A Review of the Internationalization of Chinese Enterprises. *Asia Pacific Journal of Management***,** 35(3): 573-605**.**

Álvarez, I., & Marín, R. 2010. Entry modes and national systems of innovation. *Journal of International Management*, *16*(4): 340-353.

Ambos, B., & Ambos, T.C. 2009. The impact of distance on knowledge transfer effectiveness in multinational corporations. *Journal of International Management*, 15(1): 1–14.

Ambos, B., & Ambos, T.C. 2011. Meeting the challenge of offshoring R&D: An examination of firm- and location-specific factors. *R&D Management*, 41(2): 107–119.

Ambos, B., & Håkanson, L. 2014. The concept of distance in international management research. *Journal of International Management*, 20(1): 1-7.

Ambos, B., & Schlegelmilch, B. B. 2004. The use of international R&D teams: An empirical investigation of selected contingency factors. *Journal of World Business*, 39(1): 37-48.

Anderson, E., & Gatignon, H. 1986. Modes of foreign entry: A transaction cost analysis and propositions. *Journal of International Business Studies*, 17(3): 1-26.

Anderson, J.E. 2011. The gravity model. *Annual Review of Economics*, 3(1): 133–160.

Andersson, U., & Forsgren, M. 2000. In search of centre of excellence: network embeddedness and subsidiary roles in multinational corporations. *Management International Review*, 40(4): 329-350.

Andersson, U., Bjorkman, I. & Forsgren, M. 2005. Managing subsidiary knowledge creation: The effect of control mechanisms on subsidiary local embeddedness. *International Business Review,* 14(5): 521–538.

Andersson, M., Larsson, J.P., & Wernberg, J. 2017. The Economic Microgeography of Diversity and Specialization. *IFN Working Paper* No. 1167.

Archibugi, D., & Iammarino, S. 1999. The policy implications of the globalisation of innovation. *Research Policy*, 28(2-3): 317-336.

Archibugi, D., & Michie, J. 1995. The globalisation of technology: a new taxonomy. *Cambridge Journal of Economics*, 19(1): 121-140.

Arora, A., & Fosfuri, A. 2000. Wholly owned subsidiary versus technology licensing in the worldwide chemical industry. *Journal of International Business Studies*, *31*(4): 555-572.

Arora, A., & Gambardella, A. 1990. Complementarity and External Linkages: The Strategies of the Large Firms in Biotechnology. *Journal of Industrial Economics*, 38(4): 361-380

Asakawa, K. 1996. External-internal linkages and overseas autonomy-control tension: the management dilemma of the Japanese R&D in Europe. *IEEE Transactions on Engineering Management*, 43(1): 24-32.

Asakawa, K. 2001. Organizational tension in international R&D management: the case of Japanese firms. *Research Policy*, 30(5): 735-757.

Asakawa, K., & Aoki, T. 2016. Informed headquarters, legitimized subsidiary, and reduced level of subsidiary control in international R&D management. In Ambos, T., Ambos, B., & Birkinshaw, J. (Eds.), *Perspectives on Headquarters-subsidiary Relationships in the Contemporary MNC*: 191-213. Binglay, UK: Emerald Group Publishing Limited.

Asakawa, K., Park, Y., Song, J., & Kim, S. J. 2018. Internal embeddedness, geographic distance, and global knowledge sourcing by overseas subsidiaries. *Journal of International Business Studies*, *49*(6): 743-752.

Athukorala, P. C., & Kohpaiboon, A. 2010. Globalization of R&D by US-based multinational enterprises. *Research Policy*, *39*(10), 1335-1347.

Awate, S., & Mudambi, R. 2018. On the geography of emerging industry technological networks: The breadth and depth of patented innovations. *Journal of Economic Geography*, 18(2): 391-419.

Awate, S., Larsen, M. M., & Mudambi, R. 2015. Accessing vs sourcing knowledge: A comparative study of R&D internationalization between emerging and advanced economy firms. *Journal of International Business Studies*, 46(1): 63-86.

Aykol, B., Palihawadana, D., & Leonidou, L. C. 2013. Research on the import activities of firms 1960–2010. *Management International Review*, 53(2): 215-250.

Balland, P. A., Boschma, R., & Frenken, K. 2015. Proximity and innovation: From statics to dynamics. *Regional Studies*, 49(6): 907-920.

Bartlett, C. & Ghoshal, S. 1989. *Managing across borders: The transnational solution*, Boston, MA: Harvard Business School Press.

Bartlett, C. & Ghoshal, S. 1990. Managing innovation in the transnational corporation. In C.A. Bartlett, Y. Doz & G. Hedlund (Eds.) *Managing the global firm*: 215-255. London: Routledge.

Bartlett, C. A., & Beamish, P. W. 2018. *Transnational Management: Text and Cases in Cross-border Management*. Cambridge, UK: Cambridge University Press.

Bathelt, H., Malmberg, A., & Maskell, P. 2004. Clusters and knowledge: local buzz, global pipelines and the process of knowledge creation. *Progress in Human Geography*, 28(1): 31-56.

Baumeister, R. F., & Leary, M. R. 1997. Writing narrative literature reviews. *Review of General Psychology*, 1(3): 311-320.

Beaudry, C., & Schiffauerova, A. 2009. Who's right, Marshall or Jacobs? The localization versus urbanization debate. *Research Policy*, 38(2): 318–337.

Behrman, J. N. 1984. *Industrial Policies: International Restructuring and Transnationals*, Lexington, MA: Lexington Books.

Behrman, J. N., & Fischer, W. A. 1980a. *Overseas R&D Activities of Transnational Corporations*. Cambridge, MA: Oelgeschlager, Gunn and Hain.

Behrman, J. N., & Fischer, W. A. 1980b. Trans-national corporations-market orientations and R-and-D abroad. *Columbia Journal of World Business*, 15(3):55-60.

Belderbos R., Leten B., & Suzuki S. 2013. How global is R&D? Firm-level determinants of home-country bias in R&D, *Journal of International Business Studies*, 44(8): 765-786.

Belderbos, R. 2003. Entry mode, organizational learning, and R&D in foreign affiliates: Evidence from Japanese firms. *Strategic Management Journal*, 24(3): 235-259.

Belderbos, R., Carree, M., Diederen, B., Lokshin, B., & Veugelers, R. 2004. Heterogeneity in R&D cooperation strategies. *International Journal of Industrial Organization*, 22(8): 1237-1263.

Belderbos, R., Sleuwaegen, L., Somers D. & De Backer, K. 2016. Where do locate innovative activities in global value chain. Does co-location matter? OECD Science, Technology and Industry Policy Papers, No. 30, Paris: OECD Publishing.

Bem, D. J. 1995. Writing a review article for Psychological Bulletin. *Psychological Bulletin*, 118(2): 172-177.

Berry, H., Guillen, M., & Zhou, N. 2010. An institutional approach to cross-national distance. *Journal of International Business Studies*, 41(9): 1460–1480.

Beugelsdijk, S., & Frijns, B. 2010. A cultural explanation of the foreign bias in international asset allocation. *Journal of Banking and Finance*, 34(9): 2121–2131.

Birkinshaw, J. 1994. Approaching heterarchy: a review of the literature on multinational strategy and structure. *Advances in International Comparative Management*, *9*(1): 111-144.

Birkinshaw, J. 1996. How multinational subsidiary mandates are gained and lost. *Journal of International Business Studies*, 27(3): 467-495.

Birkinshaw, J.M. & Hood, N. 1998. Multinational subsidiary evolution: capability and charter change in foreign-owned subsidiary companies. *Academy of Management Review*, 23(4): 773-795.

Birkinshaw, J.M., Hood, N., & Jonsson, S. 1998. Building firm-specific advantages in multinational corporations: the role of subsidiary initiative. *Strategic Management Journal*, 19(3): 221-241.

Blanc, H., & Sierra, C. 1999. The internationalisation of R&D by multinationals: a trade-off between external and internal proximity. *Cambridge Journal of Economics*, 23(2): 187-206.

Blomkvist, K., Kappen, P., & Zander, I. 2010. Quo vadis? The entry into new technologies in advanced foreign subsidiaries of the multinational enterprise. *Journal of International Business Studies*, 41(9): 1525-1549.

Blomkvist, K., Kappen, P., & Zander, I. 2014. Superstar inventors—Towards a people-centric perspective on the geography of technological renewal in the multinational corporation. *Research Policy*, 43(4): 669-682.

Blomkvist, K., Kappen, P., & Zander, I. 2019. Who is in and who is out? Integration of technological knowledge in the multinational corporation. *Industrial and Corporate Change*, 28(3): 437-457.

Blomström, M., & Kokko, A. 1996. *The impact of foreign investment on host countries: a review of the empirical evidence*. World Bank Policy Research Working Paper, 1745, Washington: The World Bank.

Blum, B.S., & Goldfarb, A. 2006. Does the internet defy the law of gravity? *Journal of International Economics*, 70(2): 384–405.

Bonin, B. & Perron, B. 1986. World product mandates and firms operating in Quebec. In H. Etemad & L.S. Dulude, (Eds.), *Managing the multinational subsidiary*: 161-176. London: Croom Helm.

Bournakis, I., Papanastassiou, M., & Pitelis, C. 2019. The impact of multinational and domestic enterprises on regional productivity: evidence from the UK. *Regional Studies*, 53(2):159-170.

Branstetter, L. 2006. Is Foreign Direct Investment a Channel of Knowledge Spillovers? Evidence form Japan's FDI in the United States. *Journal of International Economics*, 68(2): 325–344.

Brash, D. T. 1966. *American Investment in Australian Industry*. Canberra: Australian National University Press.

Buciuni, G. & Finotto, V. 2016. Innovation in Global Value Chains: Colocation of Production and Development in Italian Low-Tech Industries. *Regional Studies*, 50 (12): 2010-2023.

Buckley, P. J., Devinney, T. M., & Tang, R. W. 2013. Meta-analytic research in international business and international management. In Devinney, T., Pedersen, T., & Tihanyi, L. (Eds.), *Philosophy of Science and Meta-Knowledge in International Business and Management*: 263-297. Binglay, UK: Emerald Group Publishing Limited.

Buckley, PJ. & Casson, M.C. 1976. *The Future of the Multinational Enterprise*. London: Macmillan.

Buckley, P. J., & Strange, R. 2015. The governance of the global factory: Location and control of world economic activity. *Academy of Management Perspectives*, 29(2): 237-249.

Bureth, A., Wolff, S., & Zanfei, A. 1997. The two faces of learning by cooperating: the evolution and stability of inter-firm agreements in the European electronics industry. *Journal of Economic Behavior & Organization*, *32*(4): 519-537.

Cantwell J. & Iammarino S. 2003. *Multinational corporations and European regional systems of innovation*. London: Routledge.

Cantwell, J & Noonan C. A. 2002. Technology Sourcing by Foreign-Owned MNEs in Germany: An Analysis Using Patent Citations. EIBA Annual Conference, Athens, December.

Cantwell, J. 1995. The globalisation of technology: what remains of the product cycle model? *Cambridge Journal of Economics*, 19(1): 155-174.

Cantwell, J. 2017. Innovation and international business. *Industry and Innovation*, 24(1): 41-60.

Cantwell, J., & Mudambi, R. 2000. The location of MNE R&D activity: the role of investment incentives. *Management International Review*, 40(1): 127-148.

Cantwell, J., & Mudambi, R. 2005. MNE competence-creating subsidiary mandates. *Strategic Management Journal*, 26 (12): 1109-1128.

Cantwell, J., Dunning, J. H., & Lundan, S. M. 2010. An evolutionary approach to understanding international business activity: The co-evolution of MNEs and the institutional environment. *Journal of International Business Studies*, 41(4): 567-586.

Cantwell, J.A. 1989. *Technological innovation and multinational corporations*. Oxford: Blackwell.

Casella, A., & Rauch, J.E. 2003. Overcoming informational barriers to international resource allocation: Prices and ties. *The Economic Journal*, 113(1): 21–42.

Cassiman, B., & Veugelers, R. 2002. R&D cooperation and spillovers: some empirical evidence from Belgium. *The American Economic Review*, 92(4): 1169-1184.

Castellani D, & Santangelo G. 2016. Quo vadis? Cities and the location of cross-border activities, 6th Reading IB Conference, Henley Business School, 6-8 April, Reading, UK.

Castellani D. & Lavoratori K. 2019. The Lab and the Plant. Offshore R&D and Co-location with Production Activities. Journal of International Business Studies, advance online publication.

Castellani, D. & Zanfei, A. 2002. Multinational Experience and Linkages with Local Firms. Evidence from the Electronics Industry. *The Cambridge Journal of Economics*, 26(1):1-25.

Castellani, D. & Zanfei, A. 2004. Choosing international linkage strategies in electronics industry. The role of multinational experience. *Journal of Economic Behaviour and Organisation*, 53(4): 447-475

Castellani D. 2018. The Changing Geography of Innovation and the Multinational Enterprise. In G. Cook, J. Johns, F. McDonald, J., Beaverstock & N. Pandit (Eds.) *The Routledge Companion to International Business and Economic Geography*: London: Routledge, Ch. 27.

Castellani D., Rullani E. & Zanfei A. 2017. Districts, multinationals and global/digital networks, *Economia e Politica Industriale*, 44 (4): 429-447

Castellani, D., & Pieri, F. 2013. R&D offshoring and the productivity growth of European regions. *Research Policy*, 42(9): 1581–1594.

Castellani, D., & Zanfei, A. 2006. *Multinational Firms, Innovation and Productivity*. Cheltenham, UK: Edward Elgar.

Castellani, D., Jimenez, A., & Zanfei, A. 2013. How remote are R&D labs? Distance factors and international innovative activities. *Journal of International Business Studies*, 44(7): 649-675.

Castellano, S., Davidson, P., & Khelladi, I. 2017. Creativity techniques to enhance knowledge transfer within global virtual teams in the context of knowledge-intensive enterprises. *The Journal of Technology Transfer*, 42(2): 253-266.

Castelli, C., & Castellani, D. 2013. The internationalisation of R&D: sectoral and geographic patterns of cross-border investments. *Economia e Politica Industriale*, 40(1): 127-143.

Caves, R.E. 1982, 1996. *Multinational Enterprise and Economic Analysis*. Cambridge, UK: Cambridge University Press.

Chabowski, B. R., Samiee, S., & Hult, G. T. M. 2013. A bibliometric analysis of the global branding literature and a research agenda. *Journal of International Business Studies*, 44(6): 622-634.

Chang, S.J., Park, S. 2005. Types of firms generating network externalities and MNC's co-location decisions, *Strategic Management Journal*, 26(7): 595–615.

Chaturvedi, K., & Chataway, J. 2006. Strategic integration of knowledge in Indian pharmaceutical firms: creating competencies for innovation. *International Journal of Business Innovation and Research*, 1(1-2): 27-50.

Chen K., Zhang Y., & Fu X. 2019, International research collaboration: An emerging domain of innovation studies? *Research Policy*, 48 (1):149-168

Chesnais, F. 1992. National systems of innovation, foreign direct investment and the operations of multinational enterprises. in Lundvall B-Å (Ed.) *National Systems of Innovation: Toward a Theory of Innovation and Interactive Learning*: 259-292. London: Anthem Press.

Chiesa, V. 1996. Managing the internationalization of R&D activities. *IEEE Transactions on Engineering Management*, *43*(1): 7-23.

Child, J. 2009. Context, comparison, and methodology in Chinese management research. *Management and Organization Review*, *5*(1): 57-73.

Chun, H., & Mun, S. B. 2012. Determinants of R&D cooperation in small and medium-sized enterprises. *Small Business Economics*, *39*(2): 419-436.

Ciabuschi, F., Forsgren, M., & Martín, O. M. 2017. Value creation at the subsidiary level: testing the MNC headquarters parenting advantage logic. *Long Range Planning*, *50*(1): 48-62.

Coe, D.T., & Helpman E. 1995. International R&D spillovers, *European Economic Review*, 39(5): 859-887.

Cohen, W. M., & Levinthal, D. A. 1989. Innovation and learning: the two faces of R & D. *The Economic Journal*, 99(397):569-596.

Cohen, W. M., & Levinthal, D. A. 1990. Absorptive capacity: a new perspective on learning and innovation. *Administrative Science Quarterly*, 35(1): 128-152.

Collinson, S. C., & Wang, R. 2012. The evolution of innovation capability in multinational enterprise subsidiaries: Dual network embeddedness and the divergence of subsidiary specialisation in Taiwan. *Research Policy*, 41(9): 1501-1518.

Cordell, A. J. 1971. *The multinational firm: foreign direct investment and Canadian science policy*, Science Council of Canada, Special Study (No. 22). Ottawa: Information Canada.

Cordell, A.J. 1973. Innovation, the Multinational Corporation: Some Policy Implications for National Science Policy. *Long Range Planning*, 6(3): 22-29.

Cozza, C., Perani, G. & Zanfei, A. 2018. Multinationals and R&D cooperation: empirical evidence from the Italian R&D survey. *Economia Politica*, *35*(2): 601-621.

Creamer, D. B. 1976. *Overseas Research and Development by United States Multinationals, 1966-1975; Estimates of Expenditures and a Statistical Profile*. New York: The Conference Board.

Crescenzi, R., Dyevre, A., & Neffke F. 2018. Catalysts of Regional Innovation: How Foreign Firms allow New Places to Join the Global Innovation Context. GeoInno Conference, Barcelona, Spain.

Crescenzi, R., Rodríguez-Pose, A., & Storper, M. 2007. The territorial dynamics of innovation: a Europe–United States comparative analysis. *Journal of Economic Geography*, 7(6): 673-709.

Criscuolo P., Narula R. & Verspagen B. 2005. Role of home and host country innovation systems in R&D internationalisation: a patent citation analysis, *Economics of Innovation and New Technology*, 14(5): 417 – 433.

Crone M. 2012. *Re-thinking 'peripherality' in the context of a knowledge-intensive service dominated economy*. In Danson M. & De Souza P. (Eds.) *Regional Development in Northern Europe: Peripherality, Marginality and Border Issues*: 49–64. London: Routledge.

Cummings, J.L., & B.S. Teng, 2003. Transferring R&D knowledge: the key factors affecting knowledge transfer success . *Journal of Engineering Technology Management*, 20(1-2): 39-68.

Cusmano, L., Mancusi, M.L., & Morrison, A. 2009. Innovation and the geographical and organisational dimensions of outsourcing: evidence from Italian firm-level data. *Structural Change and Economic Dynamics*, 20(3): 183–19.

D'Agostino, L.M. 2015. The neglected effects of R&D captive off-shoring in emerging countries on the creation of knowledge at home, *Economia e Politica Industriale*, 42(1): 61-91.

D'Agostino, L.M., & Santangelo, G.D. 2012. Do overseas R&D laboratories in emerging markets contribute to home knowledge creation? *Management International Review*, 52(2): 251–273.

D'Agostino, L.M., Laursen, K., & Santangelo, G.D. 2013. The impact of R&D offshoring on the home knowledge production of OECD investing regions. *Journal of Economic Geography*, 13(1): 145–175.

D'Cruz, J. 1986. Strategic management of subsidiaries. In Etemad, H., Seguin Dulude, L., (Eds.) *Managing the Multinational Subsidiary*: 75-89. London; Croom Helm.

Dachs B. 2017. Internationalisation of R&D: A Review of Drivers, Impacts, and new Lines of Research, MPRA Paper No. 83367, 20 December 2017, Online at https://mpra.ub.uni-muenchen.de/83367/

Dachs , B., Stehrer, R. & Zahradnik, G. (eds.) 2014. *The internationalisation of Business R&D.* Cheltenham, UK: Edward Elgar.

Dachs, B., & Pyka, A. 2010. What drives the internationalization of innovation? Evidence from European patent data. *Economics of Innovation and New Technology*, 19(1): 71–86.

Davids, M., & Frenken, K. 2018. Proximity, knowledge base and the innovation process: towards an integrated framework. *Regional Studies*, 52(1): 23-34.

Davidson, W. H. 1980. The location of foreign direct investment activity: Country characteristics and experience effects. *Journal of International Business Studies*, 11(2): 9-22.

Davidson, W. H., & McFetridge, D. G. 1985. Key characteristics in the choice of international technology transfer mode. *Journal of International Business Studies*, *16*(2): 5-21.

De Backer, K., Menon, C., Desnoyers-James, I., & Moussiegt, L. 2016. Reshoring: Myth or reality? *OECD Science, Technology and Industry Policy Papers*, No. 27. Paris: OECD Publishing.

De Benedictis, L., & Taglioni, D. 2011. The gravity model and international trade. In L. De Benedictis, & L. Salvatici (Eds), *The trade impact of European Union preferential policies: An analysis through gravity model*s: 55–89. New York: Springer.

De Beule, F., & Somers, D. 2017. The impact of international R&D on home-country R&D for Indian multinationals. *Transnational Corporations*, 24(1): 27-55.

De Beule, F., & Van Beveren, I. 2019. Sources of open innovation in foreign subsidiaries: An enriched typology. *International Business Review*, 28(1): 135-147.

De Bondt, R., & Veugelers, R. 1991. Strategic investment with spillovers. *European Journal of Political Economy*, 7(3): 345-366.

De Marchi V., Di Maria E., & Gereffi G. 2018 *Local clusters in global value chains: Linking actors and territories through manufacturing and innovation*. London: Routledge.

De Meyer, A. 1992. Management of International R&D Operations. In Granstrand O., Håkanson, L. & Sjölander, S. (Eds.) *Technology Management and International Business. Internationalisation of R&D and Technology*: 163-179. New Jersey: Wiley.

De Meyer, A. 1993. Management of an international network of industrial R&D laboratories. *R&D Management*, *23*(2): 109-120.

Delgado, M., Porter, M. E., & Stern, S. 2010. Clusters and entrepreneurship. *Journal of Economic Geography*, 10(4): 495–518.

Demirbag, M., & Glaister, K.W. 2010. Factors determining offshore location choice for R&D projects: a comparative study of developed and emerging regions. *Journal of Management Studies*, 47(8): 1534–1560.

Disdier, A. C., & Head, K. 2008. The puzzling persistence of the distance effect on bilateral trade. *Review of Economics and Statistics*, 90(1): 37–48.

Dow, D., & Ferencikova, S. 2010. More than just national cultural distance: Testing new distance scales on FDI in Slovakia. *International Business Review*, 19(1): 46–58.

Dow, D., & Karunaratna, A. 2006. Developing a multidimensional instrument to measure psychic distance stimuli. *Journal of International Business Studies*, 37(5): 578–602.

Doz, Y., & Santos, J.F.P. 1997. On the management of knowledge: From the transparency of collocation and co-setting to the quandary of dispersion and differentiation. INSEAD working paper series Vol. 97/119/SM, Fontainbleau.

Driffield N. & Love J. 2004. Who learns from whom? Spillovers, competition effects and technology sourcing by foreign affiliates in the UK, Birmingham: Aston Business School Working Paper RP0215.

Driffield, N., Love, J. H. & Yang, Y. 2014. Technology sourcing and reverse productivity spillovers in the multinational enterprise : global or regional phenomenon? *British Journal of Management*, 25 (S1): 24-41.

Duerr, M. 1970. *R&D in the Multinational Company: A Survey*. Montreal: National Industrial Conference Board.

Dunning J.H. & Narula, R. 1995. The R&D activities of foreign firms in the US. *International Studies in Management & Organisation*, 25(1-2): 39-73.

Dunning, J. H. 1977. Trade, location of economic activity and the MNE: A search for an eclectic approach. In Hesselborn, P. O., Ohlin, B., & Wijkman, P. M. (Eds.) *The international allocation of economic activity*: 395-418. London; Palgrave Macmillan.

Dunning, J. H. 1992. Multinational enterprises and the globalization of innovatory capacity. In Granstrand O., Håkanson L. & Sjölander S. (Eds.) *Technology Management and International Business. Internationalisation of R&D and Technology*: 19-51. New Jersey: Wiley.

Dunning, J. H. 1994. Multinational enterprises and the globalization of innovatory capacity. *Research Policy*, *23*(1): 67-88.

Dunning, J. H. 2000. The eclectic paradigm as an envelope for economic and business theories of MNE activity. *International Business Review*, *9*(2): 163-190.

Dunning, J.H. 1958. *American Investment in British Manufacturing Industry*. London: Allen & Unwin.

Dunning, J.H. 1993. *Multinational Enterprises and the Global Economy*. Wokingham, England and Reading: Addison Wesley.

Dunning, J.H. 2009. Location and the multinational enterprise: John Dunning's thoughts on receiving the Journal of International Business Studies 2008 Decade Award. *Journal of International Business Studies*, 40(1): 20–34.

Dunning, J.H., & Lundan, S.M. 2008a. *Multinational enterprises and the global economy*. Cheltenham: Edward Elgar.

Dunning, J. H., & Lundan, S. M. 2008b. Institutions and the OLI paradigm of the multinational enterprise. *Asia Pacific Journal of Management*, *25*(4): 573-593.

Dunning, J.H., & Lundan, S.M. 2009. The internationalization of corporate R&D: a review of the evidence and some policy implications for home countries. *Review of Policy Research*, 26(1–2): 13–33.

Duriau, V. J., Reger, R. K., & Pfarrer, M. D. 2007. A content analysis of the content analysis literature in organization studies: Research themes, data sources, and methodological refinements. *Organizational Research Methods*, 10(1): 5-34.

Edler, J., Meyer-Krahmer, F., & Reger, G. 2002. Changes in the strategic management of technology: results of a global benchmarking study. *R&D Management*, 32(2): 149-164.

Elia, S., & Santangelo, G. D. 2017. The evolution of strategic asset-seeking acquisitions by emerging market multinationals. *International Business Review, 26*(5): 855-866.

Elshout, J. 1995. Significance of reverse transfer of technology and experiences with its promotion in industrialised countries. *Technovation, 15*(7): 423-435.

Erramilli, M. K. 1991. The experience factor in foreign market entry behavior of service firms. *Journal of International Business Studies, 22*(3): 479-501.

Ernst D. 1997. "From Partial to systemic Globalisation: International Production Networks in the Electronics Industry" BRIE Working Paper n. 98, Berkeley Roundtable on the International Economy, University of California at Berkeley

Ernst, D., & Kim, L. 2002. Global production networks, knowledge diffusion, and local capability formation. *Research Policy, 31*(8-9): 1417-1429.

Esposito C.R,, & Rigby, D.L. 2019. Buzz and pipelines: the costs and benefits of local and nonlocal interaction *Journal of Economic Geography*, 19 (3): 753–773

Etemad, H., & Seguin- Dulude, L. (Eds.). 1986. *Managing the Multinational Subsidiary: Response to Environmental Changes and to Host Nation R. & D. Policies*, New York: St. Martin's Press.

Etemad, H., & Seguin-Dulude, L. 1986. The Development of Technology in MNEs: A Cross-Country and Industry Study. In Etemad, H., & Seguin- Dulude, L. (Eds.) *Multinationals, Governments and Technology Transfer, London, England: Croom Helm Publishers*, 101-119.

Feldman, M. P., & Kogler, D. F. 2010. Stylized facts in the geography of innovation. *Handbook of the Economics of Innovation*, 1(1 C): 381-410.

Figueiredo, P. N. 2011. The role of dual embeddedness in the innovative performance of MNE subsidiaries: evidence from Brazil. *Journal of Management Studies*, 48(2): 417-440.

Filippetti, A., Frenz, M. & Ietto-Gillies, G. 2011. Are innovation and internationalization related? An analysis of European countries. *Industry and Innovation*, 18 (5): 437-459.

Filippetti, A., Frenz, M. & Ietto-Gillies, G. 2017. The impact of internationalization on innovation at countries' level: The role of absorptive capacity, *Cambridge Journal of Economics*, 41 (2): 413-439.

Florida, R. 1997. The globalization of R&D: Results of a survey of foreign-affiliated R&D laboratories in the USA. *Research Policy, 26*(1): 85-103.

Forsgren, M., & Pedersen, T. 1998. Centres of excellence in multinational companies: The case of Denmark. In Birkinshaw, J. & Hood, N. (eds.) *Multinational corporate evolution and subsidiary development:* 141-161. London: Palgrave Macmillan.

Fosfuri A., & Motta M. 1999. Multinationals without Advantages, *Scandinavian Journal of Economics*, 101 (4): 617-630.

Franco, C., & Gussoni, M. 2014. The role of firm and national level factors in fostering R&D cooperation: a cross country comparison. *Journal of Technology Transfer*, 39(6): 945-976.

Franco, C., Marzucchi, A., & Montresor, S. 2014. Absorptive capacity, proximity in cooperation and integration mechanisms. Empirical evidence from CIS data. *Industry and Innovation*, 21(4): 332-357.

Freeman, C. 1967. Research Comparisons: Some limitations of international comparisons of research and development expenditures are considered. *Science*, 158(3800): 463-468.

Freeman, C. 1987. *Technology Policy and Economic Performance: Lessons from Japan.* London: Frances Pinter.

Freeman, C. 1995. The 'National System of Innovation' in historical perspective. *Cambridge Journal of Economics*, 19(1): 5-24.

Freeman, C 2019. History, Co-Evolution and Economic Growth. *Industrial and Corporate Change*, 28(1): 1-44.

Frenz, M & Ietto-Gillies, G. 2009. The impact on innovation performance of different sources of knowledge. Evidence from the UK Community Innovation Survey, *Research Policy* 38 (7): 1125-1135.

Frost, T.S. 2001. The geographic sources of foreign subsidiaries' innovation, *Strategic Management Journal*, 22(2):101-123.

Fu, X., Hou, J., & Liu, X. 2018. Unpacking the relationship between outward direct investment and innovation performance: evidence from Chinese firms. *World Development*, 102: 111-123.

Garcia Sánchez, A., Molero, J., & Rama, R. 2016. Local cooperation for innovation: food and beverage multinationals in a peripheral European country. *International Journal of Multinational Corporation Strategy*, 1(2): 107-132.

García-Vega, M., Hofmann, P., & Kneller, R. 2019. Multinationals and the Globalization of R&D. *International Journal of Industrial Organization*, 63: 583-614.

Gassmann, O., & Han, Z. 2004. Motivations and barriers of foreign R&D activities in China. *R&D Management*, 34(4): 423–437.

Gassmann, O., & von Zedtwitz, M. 1999. New concepts and trends in international R&D organization. *Research Policy*, *28*(2-3): 231-250.

Gassmann, O., & von Zedtwitz, M. 2003. Trends and determinants of managing virtual R&D teams. *R&D Management*, *33*(3): 243-262.

Gatignon, H., & Anderson, E. 1988. The Multinational Corporation's Degree of Control over Foreign Subsidiaries: An Empirical Test of a Transaction Cost Explanation. *Journal of Law, Economics, & Organization*, 4(2): 305-336.

Gaur, A., & Kumar, M. 2018. A systematic approach to conducting review studies: An assessment of content analysis in 25 years of IB research. *Journal of World Business*, 53(2): 280-289.

Gereffi, G. 1999. International trade and industrial upgrading in the apparel commodity chain. *Journal of International Economics*, 48(1): 37-70.

Gereffi, G., Humphrey, J., & Sturgeon, T. 2005. The governance of global value chains. *Review of International Political Economy*, 12(1): 78-104.

Gertler M. S. 2008. Buzz without being there? Communities of practice in context. In Amin A. & Roberts J. (Eds.), *Community, Economic Creativity, and Organization*: 203–227. Oxford: Oxford University Press.

Gertler, M. 2003. Tacit knowledge and the economic geography of context, or the undefinable tacitness of being (there). *Journal of Economic Geography*, 3(1): 75-99.

Gerybadze, A., & Reger, G. 1999. Globalization of R&D: recent changes in the management of innovation in transnational corporations. *Research Policy*, 28(2-3): 251-274.

Ghemawat P. 2016, *The Laws of Globalization and Business Applications*. Cambridge, UK: Cambridge University Press.

Ghemawat, P. 2001. Distance still matters: The hard reality of global expansion. *Harvard Business Review*, 79(8): 137–147.

Ghemawat, P., & de la Mata, T. 2015. Globalization and gravity. Unpublished working paper, IESE Business School.

Ghoshal, S. & Bartlett, C. A. 1990. The multinational corporation as an inter-organisational network, *Academy of Management Review*, 15(4): 603–25

Ghoshal, S. & Bartlett, C. A. 1995. Building the entrepreneurial corporation: new organizational processes, new managerial tasks, *European Management Journal*, 13(2): 139–55

Ghoshal, S., & Bartlett, C. 1986. Tap your subsidiaries for global reach. *Harvard Business Review*, 64(6): 87-94.

Giuliani, E., Gorgoni, S., Günther, C., & Rabellotti, R. 2014. Emerging versus advanced country MNEs investing in Europe: A typology of subsidiary global–local connections. *International Business Review*, *23*(4): 680-691.

Gomes-Casseres, B., 1989. Ownership structures of foreign subsidiaries. *Journal of Economic Behavior and Organization,* 11(1): 1–25.

Goodall, K., & Roberts, J. 2003. Repairing managerial knowledgeability over distance. *Organization Studies*, 24(7): 1153–1175.

Govindarajan, V., & Ramamurti, R. 2011. Reverse innovation, emerging markets, and global strategy. *Global Strategy Journal*, 1(3-4): 191-205.

Granstrand, O. 1999. Internationalization of corporate R&D: A study of Japanese and Swedish corporations. *Research Policy*, 28(2–3): 275–302.

Granstrand, O., Håkanson, L., & Sjölander, S. 1993. Internationalization of R&D—a survey of some recent research. *Research Policy*, *22*(5-6): 413-430.

Gray, J.V., Siemsen, E. & Vasudeva, G. 2015. Colocation still matters: conformance quality and the interdependence of R&D and manufacturing in the pharmaceutical industry, *Management Science,* 61(11): 2760–2781.

Griffith, D. A., Cavusgil, S. T., & Xu, S. 2008. Emerging themes in international business research. *Journal of International Business Studies*, 39(7): 1220-1235.

Griffith, R., Harrison, R. & Van Reenen, J. 2006. How special is the special relationship? Using the impact of US R&D spillovers on UK firms as a test of technology sourcing. *American Economic Review*, 96(5): 1859–1875.

Grimpe, C., & Kaiser, U. 2010. Balancing internal and external knowledge acquisition: the gains and pains from R&D outsourcing. *Journal of management studies*, 47(8), 1483-1509.

Guimón, J., & Salazar-Elena, J. C. 2015. Collaboration in innovation between foreign subsidiaries and local universities: evidence from Spain. *Industry and Innovation*, 22(6): 445-466.

Guiso, L., Sapienza, P., & Zingales, L. 2009. Cultural biases in economic exchange? *Quarterly Journal of Economics*, 124(3): 1095–1131

Gupta, A. K., & Govindarajan, V. 1991. Knowledge flows and the structure of control within multinational corporations. *Academy of Management Review*, 16(4): 768-792.

Gupta, A. K., & Govindarajan, V. 1994. Organizing for knowledge flows within MNCs. *International Business Review*, 3(4): 443-457.

Hagedoorn, J., & Narula, R., 1996. Choosing organizational modes of strategic technology partnering: international and sectoral differences. *Journal of International Business Studies*, 27(2), 265– 284

Håkanson, L. 1981. Organization and Evolution of Foreign R & D in Swedish Multinationals. *Geografiska Annaler. Series B, Human Geography*, 63(1): 47-56.

Håkanson, L. 1990. International decentralization of R&D: The organizational challenges. In C.A. Bartlett, Y. Doz and G. Hedlund (Eds.), *Managing the* Global *Firm*: 256-278. London: Routledge.

Håkanson, L., & Kappen, P. 2016. Live and let die: A survival analysis of foreign R&D units in Swedish MNEs. *International Business Review*, 25(6): 1185-1196.

Håkanson, L., & Nobel, R. 1993a. Foreign research and development in Swedish multinationals. *Research Policy*, 22(5-6): 373-396.

Håkanson, L., & Nobel, R. 1993b. Determinants of foreign R&D in Swedish multinationals. *Research Policy*, 22(5-6): 397-411.

Håkanson, L., & Nobel, R. 2000. Technology characteristics and reverse technology transfer. *MIR: Management International Review*, 40(1): 29-48.

Håkanson, L., & Nobel, R. 2001. Organizational characteristics and reverse technology transfer. *MIR: Management International Review*, 41(4): 395-420.

Håkanson, L., & Zander, U. 1988. International management of R&D: The Swedish experience. *R&D Management*, 18(3): 217-226.

Harzing, A.W. 2007. Publish or Perish, available from https://harzing.com/resources/publish-or-perish.

He, S., Fallon, G., Khan, Z., Lew, Y. K., Kim, K. H., & Wei, P. 2017. Towards a new wave in internationalization of innovation? The rise of China's innovative MNEs, strategic coupling, and global economic organization. *Canadian Journal of Administrative Sciences/Revue Canadienne des Sciences de l'Administration*, 34(4), 343-355.

Head, K., Mayer, T., & Ries, J. 2009. How remote is the offshoring threat*? European Economic Review*, 53(4): 429–444.

Hedlund, G. 1986. The hypermodern MNC—a heterarchy? *Human Resource Management*, *25*(1): 9-35.

Hedlund, G. 1993. Assumptions of Hierarchy and Heterarchy, with Applications to the Management of the Multinational Corporation. In Ghoshal, S & E. Westney (Eds.), *Organization theory and the multinational corporation*: 211-236. London: Palgrave Macmillan.

Hedlund, G & Rolander, D. 1990. Action in heterarchies. New approaches to managing the MNC. In C.A. Bartlett, Y. Doz & G. Hedlund (Eds.), *Managing the global firm*: 15-46. London: Routledge.

Henisz, W.J., Delios, A. 2001. Uncertainty, imitation, and plant location: Japanese multinational corporations, 1990–1996, *Administrative Science Quarterly*, 46(3): 443–475.

Hennart, J. F., & Larimo, J. 1998. The impact of culture on the strategy of multinational enterprises: does national origin affect ownership decisions? *Journal of International Business Studies*, 29(3): 515-538.

Hennart, J. F., & Park, Y. R. 1993. Greenfield vs. acquisition: The strategy of Japanese investors in the United States. *Management Science*, 39(9): 1054-1070.

Hertel, G., Geister, S., & Konradt, U. 2005. Managing virtual teams: A review of current empirical research. *Human Resource Management Review*, 15(1): 69-95.

Hewitt, G. 1980. Research and development performed abroad by US manufacturing multinationals. *Kyklos*, 33(2): 308-327.

Higón, D., & Manjón Antolín, M. 2012. Multinationality, foreignness and institutional distance in the relation between R&D and productivity. *Research Policy*, 41(3): 592-601.

Hirschey, R. C., & Caves, R. E. 1981. Research and transfer of technology by multinational enterprises. *Oxford Bulletin of Economics and Statistics*, 43(2): 115-130.

Hitt, M. A., Tihanyi, L., Miller, T., & Connelly, B. 2006. International diversification: Antecedents, outcomes, and moderators. *Journal of Management*, 32(6): 831-867.

Hofstede, G. 1980. *Culture's consequences: International differences in work related values*. Beverly Hills, CA: Sage Publications.

Holl, A., & Rama, R. 2014. Foreign subsidiaries and technology sourcing in Spain. *Industry and Innovation*, *21*(1): 43-64.

Hood, N. & Young, S. 1988. Inward Investment and the EC: UK evidence on corporate integration strategies. In J.H. Dunning & P. Robson (Eds.), *Multinationals and the European Community*: 91-104. Oxford: Blackwell.

Hood, N., & Young, S. 1982. US multinational R&D: corporate strategies and policy implications for the UK. *Multinational Business*, 2(1): 10-23.

Hood, N., Young, S., & Lal, D. 1994. Strategic evolution within Japanese manufacturing plants in Europe: UK evidence. *International Business Review*, 3(2): 97-122.

Howells, J. 1990a. The internationalization of R & D and the development of global research networks. *Regional Studies*, 24(6): 495-512.

Howells, J. 1990b. The location and organisation of research and development: New horizons. *Research Policy*, 19(2): 133-146.

Howells, J. R. 1995. Going global: The use of ICT networks in research and development. *Research Policy*, 24(2): 169-184.

Huang, C. C. 2009. Knowledge sharing and group cohesiveness on performance: An empirical study of technology R&D teams in Taiwan. *Technovation*, 29(11), 786-797.

Huang, G.K. & Li, J. 2019. Adopting knowledge from reverse innovations? Transnational patents and signaling from an emerging economy, *Journal of International Business Studies*, advance online publication May 23. doi.org/10.1057/s41267-019-00241-9.

Huang, R.R. 2007. Distance and trade: Disentangling unfamiliarity effects and transport cost effects. *European Economic Review*, 51(1): 161–181.

Hymer, S. H. 1972. The multinational corporation and the law of uneven development. In J. N. Bhagwati (Ed.), *Economics and world order. From the 1970s to the 1990s*: 113–140. London: Macmillan.

Hymer, S. H., & Resnick, S. A. 1971. International trade and uneven development. In J. N. Bhagwati, R. W. Jones, R. A. Mundell, & J. Vanek (Eds.), *Trade, balance of payments and growth:* 473–505. *Amsterdam: North- Holland.*

Hymer, S.H. 1960/1976. *The International Operations of National Firms: A Study of Direct Foreign Investment*. Cambridge, MA: MIT Press.

Ietto-Gillies G. 2019. *Transnational Corporations and International Production. Concepts, Theories and Effects*. 3rd ed., Cheltenham, UK and Northampton, MA: Edward Elgar.

Ivarsson I., Alvstam G. & Vahlne J.E. 2017. Global technology development by colocating R&D and manufacturing: the case of Swedish manufacturing MNEs. *Industrial and Corporate Change*, 26 (1): 149-168.

Ivarsson, I. 2002. Transnational corporations and the geographical transfer of localised technology: a multi-industry study of foreign affiliates in Sweden. *Journal of Economic Geography*, *2*(2): 221-247.

Ivarsson, I., & Jonsson, T. 2003. Local technological competence and asset-seeking FDI: an empirical study of manufacturing and wholesale affiliates in Sweden. *International Business Review*, *12*(3): 369-386.

Ivarsson, I., & Vahlne, J. E. 2002. Technology integration through international acquisitions: The case of foreign manufacturing TNCs in Sweden. *Scandinavian Journal of Management*, 18(1): 1-27.

Iversen, E., Dachs, B., Poti B., Patel P., Cerulli G., Spallone R., Zahradnik G., Knell M., Scherngell T. & Lang F. 2017 *Internationalisation of business investments in R&D and analysis of their economic impact*. Luxembourg: EU, Directorate-General for Research and Innovation.

Jacobs, J. 1969. *The Economy of Cities.* London: Jonathan Cape.

Jha, S. K., Dhanaraj, C., & Krishnan, R. T. 2018. From Arbitrage to Global Innovation: Evolution of Multinational R&D in Emerging Markets. *Management International Review*, 58(4):633-661.

Kano, L. 2018. Global value chain governance: A relational perspective. *Journal of International Business Studies*, 49(6): 684–705.

Katz, R., & Allen, T. J. 1982. Investigating the Not Invented Here (NIH) syndrome: A look at the performance, tenure, and communication patterns of 50 R & D Project Groups. *R&D Management*, 12(1): 7-20.

Kedia, B., Gaffney, N., & Clampit, J. 2012. EMNEs and knowledge-seeking FDI. *Management International Review*, 52(2): 155-173.

Kesteloot, K., & Veugelers, R. 1995. Stable R&D cooperation with spillovers. *Journal of Economics & Management Strategy*, 4(4): 651-672.

Ketokivi, M., Ali-Yrkkö, J. 2009. Unbundling R&D and manufacturing: postindustrial myth or economic reality? *Review of Policy Research*, 26(1–2): 35–54.

Keupp, M. M., & Gassmann, O. 2009. The past and the future of international entrepreneurship: a review and suggestions for developing the field. *Journal of Management*, 35(3): 600-633.

Keupp, M. M., Palmié, M., & Gassmann, O. 2012. The strategic management of innovation: A systematic review and paths for future research. *International Journal of Management Reviews*, 14(4): 367-390.

Kim, E. H., Morse, A., & Zingales, L. 2006. What has mattered to economics since 1970. *Journal of Economic Perspectives*, 20(4), 189-202.

Kindleberger, C. P. 1969. American business abroad. *The International Executive*, 11(2): 11-12.

Kleinert, J., & Toubal, F. 2010. Gravity for FDI. *Review of International Economics*, 18(1): 1–13.

Knell, M., & Srholec, M. 2005. Innovation cooperation and foreign ownership in the Czech Republic. *Norwegian Institute for Studies in Innovation, Research and Education (NIFU-STEP).*

Kogut, B., & Singh, H. 1988. The effect of national culture on the choice of entry mode. *Journal of International Business Studies*, 19(3), 411-432.

Kogut, B., & Zander, U. 1993. Knowledge of the firm and the evolutionary theory of the multinational corporation. *Journal of International Business Studies*, 24(4): 625-645.

Kokko, A., & Blomström, M. 1995. Policies to encourage inflows of technology through foreign multinationals. *World Development*, *23*(3): 459-468.

Kotabe, M. 1990. The relationship between offshore sourcing and innovativeness of US multinational firms: an empirical investigation. *Journal of International Business Studies*, 21(4): 623–638.

Kotabe, M., Parente, R., & Murray, J. Y. 2007. Antecedents and outcomes of modular production in the Brazilian automobile industry: a grounded theory approach. *Journal of International Business Studies*, 38(1): 84-106.

Kratzer, J., Leenders, R. T. A., & Van Engelen, J. M. 2006. Managing creative team performance in virtual environments: an empirical study in 44 R&D teams. *Technovation*, 26(1): 42-49.

Kuemmerle, W. 1997. Building Effective R&D Capabilities. *Harvard Business Review*, 61-70.

Kuemmerle, W. 1999a. The drivers of foreign direct investment into research and development: an empirical investigation. *Journal of International Business Studies*, 30(1): 1-24.

Kuemmerle, W. 1999b. Foreign direct investment in industrial research in the pharmaceutical and electronics industries—results from a survey of multinational firms. *Research Policy*, 28(2-3): 179-193.

Kumar, N. 1996. Intellectual property protection, market orientation and location of overseas R&D activities by multinational enterprises. *World Development*, 24(4): 673-688.

Kumar, N. 1998. Technology generation and technology transfers in the world economy: recent trends and implications for developing countries. *Science, Technology and Society*, 3(2): 265-306.

Lall, S. 1979. The international allocation of research activity by US multinationals. *Oxford Bulletin of Economics and Statistics*, 41(4): 313-331.

Lall, S. 2000. The Technological structure and performance of developing country manufactured exports, 1985-98. *Oxford Development Studies*, 28(3): 337-369.

Lavoratori K., Mariotti S. & Piscitello, L. 2018. Co-location and Temporary Proximity of R&D and Manufacturing: Location Choice of Foreign MNEs in Italy. Barcelona, Spain : GeoInno Conference.

Le Bas, C. & Sierra, C. 2002. Location versus country advantages' in R&D activities: some further results on multinationals' locational strategies. *Research Policy*, 31(4): 589-609.

Lehrer, M., & Asakawa, K. 2002. Offshore knowledge incubation: The "third path" for embedding R&D labs in foreign systems of innovation. *Journal of World Business*, 37(4): 297-306.

Lema, R., Quadros, R., & Schmitz, H. (2015). Reorganising global value chains and building innovation capabilities in Brazil and India. *Research Policy*, 44(7): 1376-1386.

Lewin, A. Y., Massini, S., & Peeters, C. 2009. Why are companies offshoring innovation? The emerging global race for talent. *Journal of International Business Studies*, *40*(6): 901-925.

Lewin, A.Y., & Couto, V. 2006. Next generation offshoring: the globalization of innovation. Durham/ Chicago: Duke University, The Fuqua School of Business/Booz Allen Hamilton Inc.

Li, J., & Kozhikode, R. K. 2009. Developing new innovation models: Shifts in the innovation landscapes in emerging economies and implications for global R&D management. *Journal of International Management*, 15(3): 328-339.

Li, J., Strange, R., Ning, L., & Sutherland, D. 2016. Outward foreign direct investment and domestic innovation performance: Evidence from China. *International Business Review*, 25(5): 1010-1019.

Liang, N., & Parkhe, A. 1997. Importer behavior: The neglected counterpart of international exchange. *Journal of International Business Studies*, 28(3): 495-530.

Lieberman, M. B., & Asaba, S. 2006. Why do firms imitate each other? *Academy of Management Review*, 31(2): 366–385.

Liu, X., & White, S. 2001. Comparing innovation systems: a framework and application to China's transitional context. *Research Policy*, 30(7): 1091-1114.

López, A. 2008. Determinants of R&D cooperation: Evidence from Spanish manufacturing firms. *International Journal of Industrial Organization*, 26(1): 113-136.

Lundvall, B. A. 1992. *National Systems of Innovation: Towards a Theory of Innovation and Interactive Learning*, London: Pinter Publishers.

Lundvall, B.-A. 1988. Innovation as an interactive process: from user-producer interaction to the national system of innovation. In Dosi, G., Freeman, C., Nelson, R.R., Silverberg, G. and Soete, L. (Eds.) *Technical Change and Economic Theory*: 349-369. London: Pinter Publishers.

Lundvall, B. Å., Johnson, B., Andersen, E. S., & Dalum, B. 2002. National systems of production, innovation and competence building. *Research Policy*, 31(2): 213-231.

Malerba, F., & Torrisi, S. 1992. Internal capabilities and external networks in innovative activities. Evidence from the software industry. *Economics of Innovation and New Technology*, 2(1): 49-71.

Malnight, T. W. 1996. The transition from decentralized to network-based MNC structures: An evolutionary perspective. *Journal of International Business Studies*, 27(1): 43-65.

Manning, S., Massini, S., & Lewin, A.Y. 2008. A dynamic perspective on next-generation offshoring: the global sourcing of science and engineering talent. *Academy of Management Perspectives*, 22(3): 35–54.

Manolopoulos, D., Söderquist, K. E., & Pearce, R. 2011. Coordinating decentralized research and development laboratories: A survey analysis. *Journal of International Management*, 17(2): 114-129.

Mansfield, E., & Romeo, A. 1980. Technology transfer to overseas subsidiaries by US-based firms. *The Quarterly Journal of Economics*, 95(4): 737-750.

Mansfield, E., & Romeo, A. 1984. "Reverse" transfers of technology from overseas subsidiaries to American firms. *IEEE Transactions on Engineering Management*, 31(3): 122-127.

Mansfield, E., Teece, D., & Romeo, A. 1979. Overseas research and development by US-based firms. *Economica*, 46(182): 187-196.

Mariani, M. 2002. Next to production or to technological clusters? The economics and management of R&D location, *Journal of Management and Governance*, 6(2): 131-152.

Mariotti, S., Mutinelli, M., Nicolini, M., & Piscitello, L. 2014. Productivity spillovers from foreign multinational enterprises to domestic manufacturing firms: to what extent does spatial proximity matters? *Regional Studies*, 49(10): 1639-1653.

Mariotti, S., Piscitello, L. 1995. Information costs and location of FDIs within the host country: empirical evidence from Italy, *Journal of International Business Studies*, 26(2): 815–841.

Marshall, A. 1920. *Principles of Economics*. London: McMillan.

Martin, B. R. 2012. The evolution of science policy and innovation studies. *Research Policy*, 41(7): 1219-1239.

Martin, X., & Salomon, R. 2003. Knowledge transfer capacity and its implications for the theory of the multinational corporation. *Journal of International Business Studies*, 43(4): 356–373.

Martínez-Noya, A., & García-Canal, E. 2018. Location, shared suppliers and the innovation performance of R&D outsourcing agreements. *Industry and Innovation*, *25*(3): 308-332.

Martinez-Noya, A., & Narula, R. 2018. What more can we learn from R&D alliances? A review and research agenda. *Business Research Quarterly*, 21(3): 195-212.

McAleese, D., & McDonald, D. 1978. Employment growth and the development of linkages in foreign-owned and domestic manufacturing enterprises. *Oxford Bulletin of Economics and Statistics*, *40*(4): 321-339.

McCann, P. & Acs, Z. 2011. Globalization: countries, cities and multinationals, *Regional Studies*, 45(1): 17–32.

McDonough III, E. F., Kahn, K. B., & Barczaka, G. 2001. An investigation of the use of global, virtual, and colocated new product development teams. *Journal of Product Innovation Management, 18*(2): 110-120.

McEvily, B., & Zaheer, A. 1999. "Bridging ties: A source of firm heterogeneity in competitive capabilities". *Strategic Management Journal*, 20(12): 1133–1156.

Medcof, J. W. 1997. A taxonomy of internationally dispersed technology units and its application to management issues. *R&D Management*, 27(4), 301-318.

Meyer, A., & Mizushima, A. 1989. Global R&D management. *R&D Management*, 19(2): 135-146.

Meyer, K. E., & Sinani, E. 2009. When and where does foreign direct investment generate positive spillovers? A meta-analysis. *Journal of International Business Studies*, 40(7): 1075-1094.

Meyer, K. E., Mudambi, R., & Narula, R. 2011. Multinational enterprises and local contexts: The opportunities and challenges of multiple embeddedness. *Journal of Management Studies*, 48(2): 235-252.

Mihalache, O.R., Jansen, J.J., Van Den Bosch, F.A., & Volberda, H.W. 2012. Offshoring and firm innovation: the moderating role of top management team attributes. *Strategic Management Journal*, 33(13): 1480–1498.

Miotti, L., & Sachwald, F. 2003. Co-operative R&D: why and with whom? An integrated framework of analysis. *Research Policy*, 32(8): 1481-1499.

Mol, M. J. 2005. Does being R&D intensive still discourage outsourcing? Evidence from Dutch manufacturing. *Research Policy*, 34(4): 571-582.

Molero, J., & Buesa, M. 1993. Multinational companies and technological change: basic traits and taxonomy of the behaviour of German industrial companies in Spain. *Research Policy*, 22(3): 265-278.

Molero, J., Buesa, M., & Casado, M. 1995. Technological strategies of MNCs in intermediate countries: The case of Spain.in J. Molero (Ed.) *Technological innovation, multinational corporations and new international competitiveness. The case of intermediate countries*: 265-291. Reading: Harwood.

Mowery, D. C. (ed.) 1988. *International Collaborative Ventures in US Manufacturing*, Cambridge, MA: Ballinger.

Mowery, D. C., & Oxley, J. E. 1995. Inward technology transfer and competitiveness: the role of national innovation systems. *Cambridge Journal of Economics*, 19(1): 67-93.

Mowery, D. C., Oxley, J. E., & Silverman, B. S. 1996. Strategic alliances and interfirm knowledge transfer. *Strategic Management Journal*, 17(S2): 77-91.

Myles Shaver, J., & Flyer, F. 2000. Agglomeration economies, firm heterogeneity, and foreign direct investment in the United States. *Strategic Management Journal*, 21(12): 1175-1193.

Mudambi, R. 2008. Location, control and innovation in knowledge-intensive industries. *Journal of Economic Geography*, 8(5): 699-725.

Mudambi, R., Narula, R., & Santangelo, G. D. 2018. Location, collocation and innovation by multinational enterprises: a research agenda. *Industry and Innovation*, 25 (3): 229-241.

Mudambi, R., & Santangelo, G. D. 2016. From shallow resource pools to emerging clusters: The role of multinational enterprise subsidiaries in peripheral areas. *Regional Studies*, 50(12): 1965-1979.

Muralidharan, R., & Phatak, A. 1999. International R&D activity of US MNCS: An empirical study with implications for host government policy. *Multinational Business Review*, 7(2): 97–105.

Mutinelli, M., & Piscitello, L. 1998. The entry mode choice of MNEs: an evolutionary approach. *Research Policy*, 27(5): 491-506.

Nachum, L., & Zaheer, A. 2005. The persistence of distance? The impact of technology on MNE motivations for foreign investment. *Strategic Management Journal*, 26(8): 747–768.

Narula R. & Zanfei A. 2005 Globalization of Innovation: the role of multinational enterprises in Fagerberg J., Mowery D., Nelson R. (Eds.), *The Oxford Handbook of Innovation*: 318-345. Oxford: Oxford University Press.

Narula, R. 2017. Emerging market MNEs as meta-integrators: the importance of internal networks. *International Journal of Technology Management*, 74(1-4): 214-220.

Narula, R. 2003. *Globalisation and Technology, Policy.* Cambridge: Cambridge University Press.

Narula, R., & Dunning, J. H. 1998. Explaining international R&D alliances and the role of governments. *International Business Review*, *7*(4): 377-397.

Narula, R., & Duysters, G. 2004. Globalisation and trends in international R&D alliances. *Journal of International Management*, 10(2): 199-218.

Narula, R., & Hagedoorn, J. 1999. Innovating through strategic alliances: moving towards international partnerships and contractual agreements. *Technovation*, 19(5): 283-294.

Nelson, R. R. (Ed.). 1993. *National innovation systems: a comparative analysis*. Oxford: Oxford University Press.

Nieto, M.J., & Rodriguez, A. 2011. Offshoring of R&D: looking abroad to improve innovation performance. *Journal of International Business Studies*, 42(3): 345–361.

Niosi, J. 1999. The internationalization of industrial R&D: From technology transfer to the learning organization, *Research Policy*. 28(2-3): 107-117.

Niosi, J., & Godin, B. 1999. Canadian R&D abroad management practices. *Research Policy*, 28(2-3): 215-230.

Niosi, J., Saviotti, P., Bellon, B., & Crow, M. 1993. National systems of innovation: in search of a workable concept. *Technology in Society*, *15*(2): 207-227.

Nippa, M., & Reuer, J. J. 2019. On the future of international joint venture research. *Journal of International Business Studies*, 50(4): 555-597.

Odagiri, H., & Yasuda, H. 1996. The determinants of overseas R&D by Japanese firms: an empirical study at the industry and company levels. *Research Policy*, 25(7): 1059-1079.

OECD 2007. *Intellectual Assets and International Investment: A stocktaking of the evidence*. Report to the OECD Investment Committee DAF/INV/WD(2007)6. Paris: OECD.

OECD, 1986. *Technical Cooperation Agreements Between Firms: Some Initial Data and Analysis*. Paris: OECD.

OECD. 2011. *Attractiveness for innovation: Location factors for international investment.* Paris: OECD.

Orlitzky, M., Schmidt, F. L., & Rynes, S. L. 2003. Corporate social and financial performance: A meta-analysis. *Organization Studies*, 24(3): 403-441.

Owen-Smith, J., & Powell, W. W. 2004. Knowledge networks as channels and conduits: The effects of spillovers in the Boston biotechnology community. *Organization Science,* 15(1): 5-21.

Oxley, J. E., & Sampson, R. C. 2004. The scope and governance of international R&D alliances. *Strategic Management Journal*, 25(8-9): 723-749.

Padmanabhan, P., & Cho, K. R. 1999. Decision specific experience in foreign ownership and establishment strategies: Evidence from Japanese firms. *Journal of International Business Studies*, 30(1): 25-41.

Papanastassiou, M. 1999. Technology and production strategies of multinational enterprise (MNE) subsidiaries in Europe. *International Business Review*, 8(2): 213-232.

Papanastassiou, M., & Pearce, R. 1994. Host-country determinants of the market strategies of US companies' overseas subsidiaries. *Journal of the Economics of Business*, 1(2): 199-216.

Papanastassiou, M., & Pearce, R. 1997. Technology sourcing and the strategic roles of manufacturing subsidiaries in the UK: Local competences and global competitiveness. *Management International Review*, 37(1): 5-25.

Papanastassiou, M., & Pearce, R. 2009. *The strategic development of multinationals*. London: Palgrave Macmillan.

Patel, P. 1995. Localised production of technology for global markets. *Cambridge Journal of Economics*, 19(1): 141-153.

Patel, P., & Pavitt, K. 2000. National systems of innovation under strain: the internationalisation of corporate R&D.In Barrell, R, Mason, G and O'Mahony, M (Eds.), *Productivity Innovation and Economic Performance*: 217-235. Cambridge University Press.

Patel, P., & Pavitt, K. 1991. Large firms in the production of the world's technology: An important case of "non-globalisation". *Journal of International Business Studies*, 22(1): 1–21.

Patel, P., & Vega, M. 1999. Patterns of internationalisation of corporate technology: location vs. home country advantages1. *Research Policy*, 28(2-3): 145-155.

Paul, J., & Benito, G. R. 2018. A review of research on outward foreign direct investment from emerging countries, including China: what do we know, how do we know and where should we be heading? *Asia Pacific Business Review*, *24*(1): 90-115.

Paul, J., Parthasarathy, S., & Gupta, P. 2017. Exporting challenges of SMEs: A review and future research agenda. *Journal of World Business*, 52(3): 327-342.

Pearce, R. & Tavares, A-T. 2002. On the dynamics and coexistence of multiple subsidiary roles: an investigation of multinational operations in the UK. In S.M. Lundan (Ed.) *Network Knowledge in International Business*: 73-90. Cheltenham, UK: Edward Elgar.

Pearce, R. 1999a. The evolution of technology in multinational enterprises: the role of creative subsidiaries. *International Business Review*, 8(2): 125-148.

Pearce, R. D. 1999b. Decentralised R&D and strategic competitiveness: globalised approaches to generation and use of technology in multinational enterprises (MNEs). *Research Policy*, 28(2-3): 157-178.

Pearce, R. 1997.*Global Competition and Technology*. London: MacMillan.

Pearce, R. D. 1989. *Internationalization of Research and Development by Multinational Enterprises*. London: Palgrave MacMillan.

Pearce, R. D. 2017. *The development of international business: A narrative of theory and practice*. Cheltenham, UK: Edward Elgar.

Pearce, R., & Papanastassiou, M. 1999. Overseas R&D and the strategic evolution of MNEs: evidence from laboratories in the UK. *Research Policy*, 28(1): 23-41.

Pearce, R., & Papanastassiou, M. 2006. To 'almost see the world': Hierarchy and strategy in Hymer's view of the multinational. *International Business Review*, 15(2): 151-165.

Pearce, R., & Singh, S. 1992. *Globalizing research and development*. London: MacMillan.

Péréa, C., & von Zedtwitz, M. 2018. Organic vs. mechanistic coordination in distributed New Product Development (NPD) teams. *Journal of Engineering and Technology Management*, 49(3): 4-21.

Phene, A., & Tallman, S. 2018. Subsidiary development of new technologies: managing technological changes in multinational and geographic space. *Journal of Economic Geography*. 18(5): 1121-1148.

Picci, L. 2010. The internationalization of inventive activity: A gravity model using patent data. *Research Policy*, 39(8): 1070–1081.

Pietrobelli, C., & Rabellotti, R. 2011. Global value chains meet innovation systems: are there learning opportunities for developing countries? *World development*, 39(7), 1261-1269.

Pisani, N., & Ricart, J. E. 2018. Offshoring Innovation to Emerging Countries: The Effects of IP Protection and Cultural Differences on Firms' Decision to Augment Versus Exploit Home-Base-Knowledge. *Management International Review*, 58(6): 871-909.

Pisano, G. P. 1990. The R&D boundaries of the firm: an empirical analysis. *Administrative Science Quarterly*, 35(1): 153-176.

Piscitello, L., & Santangelo, G.D. 2010. Does R&D offshoring displace or strengthen knowledge production at home? Evidence from OECD countries. In F.J. Contractor, V. Kumar, S. Kundu, & T. Pedersen (Eds.), *Outsourcing and offshoring of business activities*: 191-207. Cambridge: Cambridge University Press.

Porter, M. E. 2000. Location, competition, and economic development: Local clusters in a global economy. *Economic Development Quarterly*, 14(1): 15-34.

Porter, M.E. 1986. *Competition in Global Industries.* Boston, MA: Harvard Business School Press.

Portes, R., & Rey, H. 2005. The determinants of cross-border equity flows. *Journal of International Economics*, 65(2): 269–296.

Poynter, T.A. & Rugman, A. M. 1982. World Product Mandates: How will Multinationals respond? *Business Quarterly*, 47(3): 54-61.

Powell, W. W., White, D. R., Koput, K. W., & Owen-Smith, J. 2005. Network dynamics and field evolution: The growth of interorganizational collaboration in the life sciences. *American Journal of Sociology*, 110(4): 1132-1205.

Quinn, J. B. 1969. Technology transfer by multinational companies, *Harvard University Review*, 47(6): 147-161.

Rawley, E. & Seamans, R. 2015. Intra-firm spillovers? The stock and flow effects of collocation. Columbia Business School Research Paper no. 15–2. Available at SSRN: http://ssrn.com/abstract=2544518.

Reddy, P. (Ed.) 2000. *The Globalization of Corporate R & D: Implications for Innovation Systems in Host Countries*. London: Routledge.

Ronstadt, R. C. 1977. *Research and development abroad by US multinationals*. New York: Praeger.

Ronstadt, R. C. 1978. International R&D: the establishment and evolution of research and development abroad by seven US multinationals. *Journal of International Business Studies*, 9(1): 7-24.

Ronstadt, R., & Kramer, R. J. 1983. Internationalizing industrial innovation. *Journal of Business Strategy*, 3(3): 3-15.

Rosenbusch, N., Gusenbauer, M., Hatak, I., Fink, M., & Meyer, K. E. 2019. Innovation Offshoring, Institutional Context and Innovation Performance: A Meta-Analysis. *Journal of Management Studies*, 56(1): 203-233.

Roth, K., & Morrison, A. J. 1992. Implementing global strategy: Characteristics of global subsidiary mandates. *Journal of International Business Studies*, 23(4): 715-735.

Rugman, A. M. 1981. *Inside the multinationals: The economics of international markets*. London: Croom Helm.

Rugman, A. M. 1983. Multinational Enterprises and World Product Mandates. In A.M. Rugman (ed.), *Multinationals and Technology Transfer- The Canadian Experience*: 73-90. New York: Praeger.

Rugman, A. M. & Bennett, J. 1982. Technology transfer and the world product mandating in Canada. *Columbia Journal of World Business*, 17(4): 58-62.

Rugman, A. M., & Verbeke, A. 2001. Subsidiary-specific advantages in multinational enterprises. *Strategic Management Journal*, 22(3): 237-250.

Sachwald, F. 1998. Cooperative agreements and the theory of the firm: focusing on barriers to change. *Journal of Economic Behavior & Organization*, 35(2): 203-225.

Safarian, A. E. 1966. *Foreign Ownership of Canadian Industry*. Toronto: Mc Graw Hill of Canada.

Saliola, F., & Zanfei, A. 2009. Multinational firms, global value chains and the organization of knowledge transfer. *Research policy*, 38(2): 369-381.

Salomon, R., & Wu, Z. 2012. Institutional distance and local isomorphism strategy. *Journal of International Business Studies*, 43(4): 894–909.

Sampson, R. C. 2004. Organizational choice in R&D alliances: Knowledge-based and transaction cost perspectives. *Managerial and Decision Economics*, 25(6-7): 421-436.

Santangelo, G. D., Meyer, K. E., & Jindra, B. 2016. MNE subsidiaries' outsourcing and insourcing of R&D: The role of local institutions. *Global Strategy Journal*, 6(4): 247-268.

Sartor, M. A., & Beamish, P. W. 2014. Offshoring innovation to emerging markets: Organizational control and informal institutional distance. *Journal of International Business Studies*, 45(9): 1072-1095.

Savona M. & Schiattarella R. 2005. International relocation of production and the growth of services: the case of the "Made in Italy" industries, *Transnational Corporations*, 13(2): 57-76

Schmitt, A., & Van Biesebroeck, J. 2013. Proximity strategies in outsourcing relations: The role of geographical, cultural and relational proximity in the European automotive industry. *Journal of International Business Studies*, 44(5): 475–503.

Schotter, A., & Beamish, P.W. 2013. The hassle factor: An explanation for managerial location shunning. *Journal of International Business Studies*, 44 (5): 521-544.

Shimizutani, S., & Todo, Y. 2008. What determines overseas R&D activities? The case of Japanese multinational firms. *Research Policy*, 37(3): 530–544.

Siedschlag, I., Smith, D., Turcu, C., & Zhang, X. 2013. What determines the location choice of R&D activities by multinational firms?. *Research Policy*, 42(8): 1420-1430.

Singh J. 2004. Multinational Firms and Knowledge Diffusion: Evidence using Patent Citation Data, *Academy of Management Best Papers Proceedings*, 2004(1): D1-D6.

Siotis G. 1999. Foreign Direct Investment Strategies and Firms' Capabilities, *Journal of Economics and Management Strategy*, 8(2): 251-270.

Slangen, A., & Hennart, J. F. 2007. Greenfield or acquisition entry: A review of the empirical foreign establishment mode literature. *Journal of International Management*, *13*(4): 403-429.

Slangen, A., Beugelsdijk, S., & Hennart, J. F. 2011. The impact of cultural distance on bilateral arm's length exports: An international business perspective. *Management International Review*, 51(6): 875–896.

Slangen, A.H.L., & Beugelsdijk, S. 2010. The impact of institutional hazards on foreign multinational activity: A contingency perspective. *Journal of International Business Studies*, 41(6): 980–995.

Srholec, M. 2009. Does foreign ownership facilitate cooperation on innovation? Firm-level evidence from the enlarged European Union. *The European Journal of Development Research*, 21(1): 47-62.

Srholec, M. 2015. Understanding the diversity of cooperation on innovation across countries: Multilevel evidence from Europe. *Economics of Innovation and New Technology*, 24(1-2): 159-182.

Stallkamp, M., Pinkham, B. C., Schotter, A. P., & Buchel, O. 2018. Core or periphery? The effects of country-of-origin agglomerations on the within-country expansion of MNEs. *Journal of International Business Studies*, 49(8): 942-966.

Stopford, J.M. & Wells, L.T. Jr. 1972. *Managing the Multinational Enterprise: Organisation of the Firm and Ownership of the Subsidiaries*. New York: Basic Books.

Storper, M., & Venables, A. J. 2004. Buzz: face-to-face contact and the urban economy. *Journal of Economic Geography*, *4*(4): 351-370.

Steinmueller W. 1992. The Economics of Flexible Integrated Circuit Manufacturing Technology, *Review of Industrial Organization*, 7(3-4): 327-349

Stubenitsky, F. 1970. American direct investment in the Netherlands industry: a survey of the year 1966, Rotterdam: Rotterdam University Press.

Taggart, J. H. 1996. Multinational manufacturing subsidiaries in Scotland: strategic role and economic impact. *International Business Review*, *5*(5): 447-468.

Taggart, J. H. 1997. An evaluation of the integration-responsiveness framework: MNC manufacturing subsidiaries in the UK. *Management International Review*, 37(4): 295-318.

Tecu, I. 2013. The Location of industrial innovation: does manufacturing matter?, US Census Bureau Center for Economic Studies Paper No. CES-WP-13-09. Available at SSRN: http://ssrn.com/abstract=2233366.

Teece, D. J. 1977. Technology transfer by multinational firms: The resource cost of transferring technological know-how. *The Economic Journal*, 87(346): 242-261.

Teirlinck, P., & Spithoven, A. 2013. Research collaboration and R&D outsourcing: Different R&D personnel requirements in SMEs. *Technovation*, 33(4): 142-153.

Tinbergen, J. 1962. *The world economy: Suggestions for an international economic policy*. New York: Twentieth Century Fund.

Tojeiro-Rivero D., & Moreno R. 2019. Technological cooperation, R&D outsourcing, and innovation performance at the firm level: The role of the regional context, *Research Policy*, 48 (7): 1798-1808

Torre A. & Rallet A. 2005. Proximity and localization, *Regional Studies* 39(1): 47–59.

Torre, A. 2008. On the role played by temporary geographical proximity in knowledge transmission, *Regional Studies*, 42(6): 869–889.

Townsend, A. M., DeMarie, S. M., & Hendrickson, A. R. 1998. Virtual teams: Technology and the workplace of the future. *Academy of Management Perspectives*, 12(3): 17-29.

Turkina, E., & Van Assche, A. 2018. Global connectedness and local innovation in industrial clusters. *Journal of International Business Studies*, 49(6): 706-728.

UNCTAD. 1998. *World investment report 1998: Trends and Determinants*. New York: United Nations.

UNCTAD. 2005. World Investment Report 2005. *Transnational Corporations and the Internationalization of R&D*. New York and Geneva: United Nations.

US Tariff Commission 1973. Implications of Multinational Firms for World Trade and Investment and for US Trade and Labor, Report of the US Senate, Committee on Finance, Subcommittee on International Trade, Washington: US Government Printing Office.

Vernon, R. 1966. "International investment and international trade in the product cycle", *Quarterly Journal of Economics*, LXXX (2): 190- 207.

Veugelers, R. 1997. Internal R&D expenditures and external technology sourcing. *Research Policy*, 26(3): 303-315.

Veugelers, R., & Cassiman, B. 2004. Foreign subsidiaries as a channel of international technology diffusion: Some direct firm level evidence from Belgium. *European Economic Review*, 48(2): 455-476.

Veugelers, R., & Cassiman, B. 2005. R&D cooperation between firms and universities. Some empirical evidence from Belgian manufacturing. *International Journal of Industrial Organization*, *23*(5): 355-379.

Vicente, J. & Suire, R. 2007. Informational cascades versus network externalities in locational choice: evidence of "ICT clusters" formation and stability, *Regional Studies*, 41(2): 173–184.

von Zedtwitz, M. 2003. Initial directors of international R&D laboratories. *R&D Management*, 33(4): 377-393.

von Zedtwitz, M. 2004. Managing foreign R&D laboratories in China. *R&D Management*, 34(4): 439–452.

von Zedtwitz, M., & Gassmann, O. 2002. Market versus technology drive in R&D internationalization: four different patterns of managing research and development. *Research Policy*, 31(4): 569-588.

von Zedtwitz, M., & Gassmann, O. 2016. Global corporate RnD to and from emerging countries. In S. Dutta, B. Lanvin, & S. Wunsch-Vincent (Eds.), *The global innovation index 2016*: 125–131. Ithaca, NY: Johnson Cornell University.

von Zedtwitz, M., Corsi, S., Søberg, P. V., & Frega, R. 2015. A typology of reverse innovation. *Journal of Product Innovation Management*, 32(1): 12-28.

Vrontis, D., & Christofi, M. 2019. R&D internationalization and innovation: A systematic review, integrative framework and future research directions. *Journal of Business Research*, advance online publication March 28. doi.org/10.1016/j.jbusres.2019.03.031

Wang, Y., Xie, W., Li, J., & Liu, C. 2018. What factors determine the subsidiary mode of overseas R&D by developing-country MNEs? Empirical evidence from Chinese subsidiaries abroad. *R&D Management*, *48*(2): 253-265.

Wei, Z., & Nguyen, Q. T. 2017. Subsidiary strategy of emerging market multinationals: A home country institutional perspective. *International Business Review*, *26*(5): 1009-1021.

Welch, D., & Björkman, I. 2015. The place of international human resource management in international business. *Management International Review*, 55(3): 303-322.

Westney, D. E. 1993. Cross-Pacific internationalization of R&D by US and Japanese firms. *R&D Management*, 23(2): 171-181.

White, R.E. & T.A. Poynter, T.A. 1984. Strategies for foreign-owned subsidiaries in Canada, *Business Quarterly*, 48: 59-69.

Williamson, O. E. 1988. Corporate finance and corporate governance. *The Journal of Finance*, 43(3): 567-591.

Williamson, O. E. 1992. Markets, hierarchies, and the modern corporation: An unfolding perspective. *Journal of Economic Behaviour & Organization*, 17(3): 335-352.

Wortmann, M. 1990. Multinationals and the internationalization of R&D: new developments in German companies. *Research Policy*, 19(2): 175-183.

Yamin, M. 1999. An evolutionary analysis of subsidiary innovation and 'reverse'transfer in multinational companies. In F. Burton, Chapman, M. & Cross, A. (Eds.), *International Business Organization. Subsidiary management, entry strategies and emerging markets*: 67-82. London: Palgrave Macmillan.

Yang, Q., Mudambi, R., & Meyer, K. E. 2008. Conventional and reverse knowledge flows in multinational corporations. *Journal of Management*, 34(5): 882-902.

Young, S., Hood, N., & Dunlop, S. 1988. Global strategies, multinational subsidiary roles and economic impact in Scotland. *Regional Studies*, 22(6): 487-497.

Zaheer, S. 1995. Overcoming the liability of foreignness. *Academy of Management Journal*, 38(2): 341-363.

Zaheer, S. 2015 Overcoming the liability of foreignness. In P. Buckley & P. Ghauri (Eds.), *International Business Strategy, Theory and Practice*: 362-380. London: Routledge.

Zander, I. 1999. How do you mean global'? An empirical investigation of innovation networks in the multinational corporation. *Research Policy*, 28(2-3): 195-213.

Zanfei, A. 2000. Transnational firms and the changing organisation of innovative activities. *Cambridge Journal of Economics*, 24(5): 515-542.

Zanfei A. 2012. "Effects, not Externalities" *European Journal of Development Research*, 24*(1)*: 8-14

Zejan, M. C. 1990. R & d activities in affiliates of Swedish multinational enterprises. *The Scandinavian Journal of Economics*, 92(3): 487-500.

Zeschky, M., Daiber, M., Widenmayer, B., & Gassmann, O. 2014. Coordination in global R&D organizations: An examination of the role of subsidiary mandate and modular product architectures in dispersed R&D organizations. *Technovation*, 34(10): 594-604.

Zhang, S., & Pearce, R. 2010. Sources of technology and the strategic role of MNE subsidiaries in China. *Multinational Business Review* 18(3): 49–72.

Zhao, S., Tan, H., Papanastassiou, M. & Harzing, A-W. 2019. The internationalization of innovation towards the South: A historical case study of a global pharmaceutical corporation in China (1993-2017) *Asia Pacific Journal of Management*, advance online publication January 2. doi.org/10.1007/s10490-018-9620-x

ABOUT THE AUTHORS

Marina Papanastassiou is Professor of International Business at Middlesex University Business School, London, UK. Within of the context of International Business her research is focusing on the understanding of MNEs as a differentiated network of subsidiaries and overseas R&D laboratories and their role in shaping the strategy of MNEs. A very recent stream of her research focuses on understanding how internationalization affects the survival of startups. This line of research lies at the crossroads of literature on entrepreneurship, social networks and internationalization.

Robert (Bob) Pearce was Professor of International Business Emeritus in the John H Dunning Centre for International Business in Henley Business School and the Department of Economics, University of Reading, UK. Bob was one of the founding members of the Reading School of International Business. His research focused on the global strategies of MNEs as articulated through the diverse roles played by subsidiaries and the creation and application of technology in these firms' globalised operations. A strong concern was with the derivation of an analytical framework for the evaluation of the performance and implications of MNEs and, in particular, their participation in processes of economic development.

Antonello Zanfei is Professor of Applied Economics at Urbino University, where he coordinates an international PhD Programme in Global Studies. He has been visiting professor at various academic institutions in Europe and in the USA. His research interests cover: Innovation in public and private sectors, market structure and industrial dynamics, economics of multinational enterprises, international trade. He has authored studies on multinational firms, innovation and productivity; on global value chains, R&D location decisions and offshoring; on technological spillovers of FDIs; and on inter-firm linkage creation and networking.

AKNOWLEDGEMENTS

The Authors are thankful to, Ilan Vertiski (Editor) and Alain Verbeke (Editor- in- Chief) for their guidance and support during the review process . We also thank, Davide Castellani, Grazia Ietto Gillies, Martin Srholec and the participants in several international conferences and workshops, for their useful suggestions on previous versions of this paper. Last but not least, we would like to express our appreciation to the three anonymous reviewers for their constructive and insightful comments. The usual disclaimers apply.

TABLES AND FIGURES

Figure 1: Methodological steps followed in the review procedure

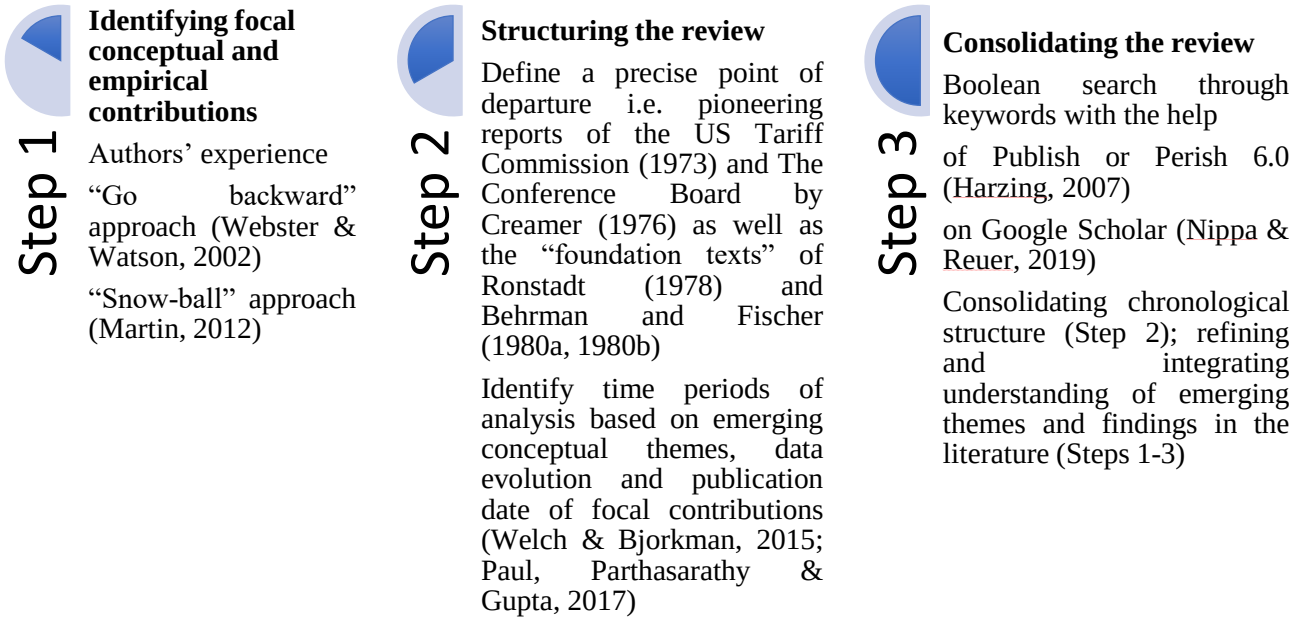

Table 1 – The evolution in time of the literature on R&D internationalization. Key themes, data-sources and main references			
Period	**Key Themes**	**Data sources**	**Focal papers (in chronological order)**
1970s- early 1980s	- Demand side determinants of overseas R&D; - Centripetal versus centrifugal forces in R&D internationalization; - Heterogeneity of overseas R&D laboratories and first typologies subsidiary roles	BEA data; Ad hoc surveys; firm level published data; case studies	Cordell (1971; 1973); US Tariff Commission (1973); Creamer (1976); Ronstadt (1977; 1978); Dunning (1977); Lall (1979); Mansfield, Teece & Romeo (1979); Behrman & Fischer (1980a, 1980b); Hewitt (1980); Mansfield & Romeo (1980); Håkanson, (1981); Hirschey & Caves (1981); Poynter & Rugman (1982); Rugman (1983); Rugman & Bennett (1982); White & Poynter (1984); Mansfield & Romeo (1984)
1980s- early 2000s	- Taxonomies of overseas R&D - Supply side determinants of R&D internationalization and knowledge sourcing; - Role of R&D FDIs and MNEs in NSI; - organizational restructuring of MNEs and R&D internationalization - International R&D linkages with external parties and spillovers	Survey data; patent data; press-based datasets on technical alliances; OECD AFA data; case studies	Freeman (1987); Cantwell (1989); Pearce (1989); Bartlett & Ghoshal (1990); Howells (1990a. 1990b; 1995); Dunning (1992; 1994); Roth & Morrison (1992); Pearce & Singh (1992); Chesnais (1992); Lundvall (1992); De Meyer (1993); Granstrand, Håkanson, & Sjölander, (1993); Hakanson & Nobel (1993a, 1993b); Nelson (1993); Westney (1993); Hood, Young & Lal (1994); Coe & Helpmann (1995); Archibugi & Michie (1995); Molero, Buesa & Casado (1995); Mowery & Oxley (1995); Narula & Dunning (1995); Almeida (1996); Chiesa (1996); Florida (1997); Kuemmerle (1997); Medcof (1997); Pearce, (1997); Forsgren & Pedersen (1998); Kuemmerle (1999a, 1999b); Gassmann & von Zedtwitz (1999); Pearce & Papanastassiou (1999); Pearce (1999a, 1999b); Zander (1999); Niosi & Godin, (1999); Patel & Vega (1999); Zanfei (2000); Lehrer & Asakawa (2002); Von Zedtwitz & Gassmann (2002)
2000s -onward	- Quantifying asset-exploiting, asset seeking and asset augmenting strategies; - R&D FDI location, co-location and agglomeration forces; - The changing role of distance factors in the internationalization of R&D; - R&D offshoring; reshoring; virtual teams; temporary proximity - co -location and the changing geography of R&D internationalization; - emerging countries MNEs, GVCs and internationalization of R&D	Systematic use of longitudinal databases at the national, regional and sub-regional levels; and the sectoral, firm and functional levels. These include: official trade and FDI statistics and datasets relying on official statistics (IMF, Eurostat, BEA, UNCTAD, WIO, TiVA); innovation and patent data statistics (CIS, R&D scoreboards; COR&DIP; EPO, USPTO, JPTO; OECD-REGPAT); Commercial databases (Bureau Van Dijk's Orbis-Amadeus; Dun and Bradstreet's Who Owns Whom; FT's fDiMarkets); national statistical sources; survey data and case studies	Le Bas & Sierra (2002); Cantwell & Iammarino (2003); Ivarsson & Jonsson (2003); Narula (2003); Driffield & Love (2004); Storper & Venables (2004); Veugelers & Cassiman (2004); Cantwell & Mudambi (2005); Narula & Zanfei (2005); Branstetter (2006); Cassiman & Vegeulers (2002); Castellani & Zanfei (2006); UNCTAD (2005); Griffith, Harrison & Van Reenen (2006); Pearce & Papanastassiou (2006); Dunning & Lundan (2009); Demirbag & Glaister (2010); Piscitello & Santangelo (2010); Meyer, Mudambi & Narula. (2011); D'Agostino & Santangelo (2012); Crone (2012); Belderbos, Leten & Suzuki (2013); Castellani, Jimenez & Zanfei (2013); Dachs, Stehrer, & Zahradnik (2014); Driffield & Love (2014); Srholec (2015); Alcácer, Cantwell, & Piscitello (2016); Belderbos, Sleuwaegen, Somers & De Backer (2016); Ghemawat (2016); Mudambi & Santangelo (2016); Santangelo, Meyer & Jindra (2016); Castellano, Davidson & Khelladi (2017); Castellani (2018); Péréa & von Zedtwitz (2018); Cozza, Perani & Zanfei (2018); Martinez- Noya & Garcia-Canal (2018); Phene &Tallman (2018); De Beule & Van Beveren (2019); Castellani & Lavoratori (2019).

Table 2: Responding to RQ1: *How do changing views of R&D internationalization combine with the availability of new data-sources and empirical findings?*

	Conceptual issues	Measurement and empirical issues

1970s-early 1980s	• The initial perception: Cross-border R&D as a challenge to the virtues of centralised innovation
	  ○ Technology developed at home is adapted to local demand conditions
	  ○ Centripetal forces limit the internationalization of R&D
	• Gradual understanding of the growing role of foreign units in the absorption, development and transfer of knowledge
		• Correlations between R&D FDIs and foreign sales
		• Survey based analyses of overseas R&D laboratories and subsidiaries

1980s-early 2000s	• Changes in the organization of cross-border innovation:
	  ○ multiple sources of innovation within MNEs
	  ○ involvement of MNEs in technical linkages with local firms and with other MNEs
	• Supply side factors underlying R&D internationalization are emphasised: new theorising on asset seeking and knowledge sourcing
	• The impact of R&D FDIs on home and host economies comes at center stage: hollowing out and spillover stories
		• A plurality of taxonomies of overseas R&D laboratories
		• Largely impressionistic evidence on knowledge sourcing/asset seeking strategies, based on surveys, case histories and patent data
		• Cross-section econometric studies at the sectoral level are used as (rough) evidence of technological spillovers of FDIs in general and of R&D FDIs in particular

2000s - onward	• R&D internationalization plays a key role in the debate on MNEs' (ex ante and ex post) advantages
	• Exploring the links between internal networks/external networks/multiple embeddeness and R&D internationalization
	• Detecting causal relations between R&D FDIs and the performance of local firms
	• Increasing attention to new geographic patterns of R&D internationalization:
	  ○ Agglomeration dynamics
	  ○ New players (emerging countries and EMNEs)
	  ○ New geographical levels of analysis: regions and cities
	• R&D FDIs play a key role in shaping GVCs and at generating upgrading opportunities
		• Longitudinal firm level data on cross-border innovation allow more systematic evidence on:
		  ○ R&D localization patterns
		  ○ Asset seeking, asset exploiting and asset augmenting strategies
		  ○ Technological spillover effects of FDIs on local economies
		• Proliferation of empirical studies on "external" and "internal" agglomeration processes
		• Fine grained mapping of R&D internationalization at the national, regional and local level
		• Use of functional level FDI data to capture R&D localization and the evolution of GVCs

Table 3: Responding to RQ2: *How did the literature on R&D internationalization incorporate contributions from different disciplines?*	
Converging streams of literature	

1970s-early 1980s	• IB meets innovation literature
	  o MNEs are endowed with a superior technology
	  o Ex ante technological advantages combine with internalization and localization advantages
	  o Tensions between cross-border knowledge exploitation and appropriability
	• R&D internationalization literature meets organizational theory
	  o Theorising of R&D centralization reflects hierarchical views of MNEs
	  o Heterogeneity of R&D affiliates and of their relations with HQs

1980s-early 2000s	• Changes in organizational theories (e.g. Heterarchical and Networked models of the MNE) proceed hand in hand with changing perspectives on the internationalization of R&D • Evolutionary theorizing of economic change cross-contaminate with technological accumulation approaches to international production and R&D internationalization • R&D FDIs and MNEs play a crucial role in National Innovation Systems theorizing • Transaction cost approaches and dynamic capabilities theorising affect R&D entry mode literature

2000s - onward	• Literature on R&D internationalization increasingly connects to:
	  o Studies on the geography of innovation
	  o Works on global value chains, technological upgrading and development
	  o IB and international trade views on the role of distance factors in R&D location decisions
	  o Theorising on networking both within MNEs and across MNEs' boundaries (double networking/dual embeddedness)
	  o Studies on productivity and firm performances

APPENDIX I

Keyword- based search, procedure and results

We have conducted boolean search through Google Scholar for a number of keywords related to the main theme of this review i.e. R&D internationalization. We present here the outcome of this exercise based on a sample of 20 keywords (listed in table I.1) in an effort to capture the historical evolution of terms used in the literature through time[1]. The final outcome of this search resulted in a grand total of 15,100 entries. Excluding non-English publications and publications with less than 10 citations we resulted in 7,653 entries including self-citations[2] and duplicates (we identified 2,563 duplicates) i.e. entries appearing in more than one keyword categories. Although the cutting point of 10 citations is arbitrary, it is adopted as we wanted to secure the inclusion of recently published papers[3]. As a first observation, the high number of duplicates reflects the fact that authors use different terms interchangeably to capture R&D internationalization. As it can be observed in Table I.1 the keywords with the highest entries are the ones that contain the words "R&D expenditures", "international" and "internationalized", "foreign" and "overseas" R&D.

In Table I.2 we show the distribution of entries by keyword and publication date (i.e. age of entries). As it can be observed, the fact that we included only papers with 10 citations or more did not compromise the inclusion of recently published papers (i.e. in 2018 or 2017). The keywords with the oldest recorded entries are dated back between 52-48 years. Such keywords are: "R&D expenditures", "science policy and multinationals", "foreign R&D", "Overseas R&D/ Overseas R&D laboratories" and "Decentralization of R&D/Decentralized R&D and MNES",[4] confirming that the departing point chosen for this review (the 1970s) does correspond to the period when more systematic research on the subject starts to take place. Keywords containing terms, such as "GVCs" or "offshoring" or "knowledge" appear more recently in the bibliography i.e. less than 20 years ago. The gradual appearance of new keywords reflects the conceptual evolution in the field, departing from dyadic notions e.g. "domestic versus foreign" or "centralization vs. decentralization" and embracing more articulated analyses of the phenomenon of R&D internationalization, e.g. studies addressing the issue within the context of knowledge transfer or GVCs. This conceptual evolution provides support for the chronological structure adopted in this review.

In terms of the academic journals we included in our review, leading IB and strategy journals (i.e. *Journal of International Business Studies* (JIBS), *International Business Review* (IBR), *Management International Review* (MIR), *Journal of World Business* (JWB) and *Strategic Management Journal* (SMJ)) are represented with 98 entries; Innovation Management Journals (i.e. *Research Policy*, *Technovation*, *R&D Management*, *IEEE*, *Journal of Product Innovation Management* and *Journal of Technology Transfer*) are represented with 72 entries whilst international economics, economic geography and other economic journals are represented with 79 entries.

[1] We do acknowledge that different spellings condition the keyword search. We thus expect that this maybe another factor that may have contributed to possible omissions (Martin, 2012).
[2] As it is argued in Martin (2012) self-citations is usually a small proportion of cites in particular in high-cited papers.
[3] Some of the recent papers discussed in the review, e.g. published in 2019, although they may have less than 10 citations are still included in our analysis reflecting the three steps we followed stated in the methodology.
[4] The four oldest recorded entries include Freeman (1967), Quinn (1969), Duerr (1970) and Cordell (1971).

Table I.1: Frequency distribution of entries by Keyword

	Keyword	Frequency	Percent
1	GVCs and MNE R&D/ R&D location	323	4.2
2	Reverse technology transfer	276	3.6
3	Offshoring R&D	91	1.2
4	Internationalization of R&D	727	**9.5**
5	Decentralization of R&D/ Decentralized R&D and MNES	319	4.2
6	Foreign R&D	760	**9.9**
7	Cross-border R&D	181	2.4
8	R&D FDI	160	2.1
9	Globalization of Innovation + Globalized R&D and MNEs	488	6.4
10	Multinational R&D	331	4.3
11	Overseas R&D/Overseas R&D laboratories	614	8.0
12	International R&D	909	**11.9**
13	Multinational Innovation	57	.7
14	Knowledge transfer in Multinationals/MNEs	63	.8
15	MNE Innovation	67	.9
16	MNE R&D	148	1.9
17	Science Policy and Multinationals	238	3.1
18	R&D expenditures	916	**12.1**
19	Technology sourcing and FDI	353	4.4
20	MNEs and NSIs	639	8.3
	Total	7653	100

Source: Authors' calculations (Publish or Perish, 6.0: Google Scholar Search: 16.04.19)
Note: It contains entries with 10 citations and above. It includes duplicates.

Table I.2: Frequency distribution of entries by Keyword and Age (date of publication)

Age						
	Keyword	Mean	N	Std. Deviation	Minimum	Maximum
1	GVCs and MNE R&D/ R&D location	7.07	323	3.668	1	19
2	Reverse technology transfer	12.46	276	7.114	2	35
3	Offshoring R&D	8.18	91	3.437	1	15
4	Internationalization of R&D	13.21	727	6.334	1	40
5	Decentralization of R&D/Decentralized R&D and MNES	15.54	319	7.415	1	**48**
6	Foreign R&D	14.37	760	6.930	1	**49**
7	Cross-border R&D	10.41	181	5.562	1	27
8	R&D FDI	10.53	160	4.234	2	24
9	Globalization of Innovation/ Globalized R&D and MNEs	9.92	488	5.149	1	29
10	Multinational R&D	13.74	331	7.313	2	41
11	Overseas R&D/ Overseas R&D laboratories	14.76	614	7.917	1	**49**
12	International R&D	14.49	909	6.918	1	44
13	Multinational Innovation	11.14	57	6.013	1	29
14	Knowledge transfer in Multinationals/MNEs	6.40	63	3.165	1	14
15	MNE Innovation	8.42	67	4.921	1	27
16	MNE R&D	11.34	148	5.585	1	30
17	Science Policy and Multinationals	20.55	238	10.257	1	**50**
18	R&D Expenditures	17.44	916	9.151	1	**52**
19	Technology Sourcing and FDI	12.31	353	5.282	1	29
20	MNEs and NSIs	11.89	639	6.055	1	43

Source: Authors' calculations (Publish or Perish, 6.0: Google Scholar Search: 14.04.19- 20.4.19)

NOTES

[1] In this paper we adopt Belderbos, Sleuwaegen, Somers & De Backer (2016: 8) definition of R&D and innovation in which: 'innovation is much broader than only R&D, innovation activities in the empirical analysis include pure research (the R of R&D), pure development (the D), R&D, but also design and testing that are often part of development activities'.

[2] Several host-country studies had indicated the presence of R&D by, in particular, US MNEs (Dunning, 1958, Safarian, 1966; Brash, 1966). Particularly revealing may be the evidence of Stubenitsky (1970, 71-3) who surveyed 111 subsidiaries of US MNEs operating in the Netherlands in 1966. Of these 111 subsidiaries 87 (73%) said their parent MNEs had an R&D programme with this, it appeared, already extending into European activities. Thus, of the 87 parent companies 43 (49%) had R&D operations in the Netherlands with six of these also having other units elsewhere in Europe, whilst 11 of the parent companies that did not have R&D in their Dutch subsidiaries reporting it elsewhere in Europe.

[3] For example, in early studies, patent data show little R&D internationalisation (Patel &Pavitt 1991, Patel, 1995; Archibugi and Michie, 1995). One should observe inter alia that, due to data limitations, these studies could not fully capture the increase in foreign R&D associated with mergers and acquisitions, which have historically represented a key element in the process of R&D internationalisation. Indeed, some works based on case studies or survey data did acknowledge for the variety of channels through which cross-border R&D had already taken place in the early stages of MNEs expansion and account for a greater degree of internationalisation of innovative activities (Warrant, 1991; Kuemmerle,1999a).

[4] See Pearce (1989: 11-21) for a summary of this data from 1966 to 1982.

[5] Another ratio that was also calculated from the data was the R&D intensity of overseas operations (R&D expenditure divided by sales) by industry, host country and time. Studies that later tested this ratio include Papanastassiou and Pearce (1997), Kumar (1996), Sejan (1990). See UNCTAD (2005) and Dachs, Stehrer & Zahradnik (2014) for more recent documentation of R&D intensity of MNEs' foreign activities.

[6] For his report to The Conference Board, Creamer (1976) surveyed 75 leading US MNEs and their foreign affiliates in 1973. This study focused on a range of organisational and structural issues: types of R&D carried out, R&D cost structures, financing of the overseas R&D. The review of this material clearly suggested significant differences of the overseas R&D operations from comparable behaviour of the parent company.

[7]Three of the laboratory types defined by Ronstadt can, to some degree, be projected into approaches to innovation distinguished by Bartlett and Ghoshal (1989, 1990). Thus, what he called "Indigenous Technology Units" (ITUs) represent the types of initiatives taken, on an *ad hoc* basis, by subsidiaries in their traditional 'local-for-local' approach. Then "Global Technology Units" (GTUs) can fit into their transnational 'locally leveraged' approach, where a subsidiary takes full responsibility for innovation but with the full recognition and authorisation of the parent, who sees it as an element of a more integral global approach. The constrained, basic research, focus of "Corporate Technology Units" (CTUs) would then relate to Bartlett and Ghoshal's more tentative suggestions of a 'globally linked' innovation programme. Ronstadt and Kramer (1983) had identified ten techniques that could be used to internationalise innovation and distinguish the presence of overseas R&D as clearly central to this.

[8] Empirical evidence reaches conflicting conclusions. Patent data show little R&D internationalisation (Patel, 1995; Archibugi & Michie, 1995; Patel & Vega, 1999) whilst case or survey data show the contrary (Granstrand, Håkanson, & Sjölander 1993; Kuemmerle, 1999a). As a result, the debate on internationalisation of MNE R&D becomes more ambiguous with some researchers claiming that it was not a generalised phenomenon.

[9] The March 1999, Vol. 28, No.2-3 Special Issue of Research Policy on *The Internationalization of Industrial R&D* as well as the Cambridge Journal of Economics Vol. 19, No. 1, February 1995 Special Issue on *Technology and Innovation* are considered as pivotal in mapping the theoretical and empirical developments in the globalisation of innovation.

[10] As it was also acknowledged by Håkanson & Nobel (2000:31), in the 1980s and 1990s little attention was given to the managerial challenges involved in the 'control and coordination of global R&D' with works by De Meyer (1992), Håkanson and Nobel (1993a, 1993b), Asakawa (1996), Håkanson and Zander (1988), Gerybadge and Reger (1999), Gassmann and Von Zedtwitz (1999) being among the few. However, this became a dominant theme in the study for internationalisation of R&D from 2000 onward (Asakawa, 2001).

[11] Cantwell (1995:172) in a similar tone concluded that: 'The affiliates of the leading companies in other major centres may be thought of as constituting an interactive network'.

[12] In their differently configured typology of subsidiary roles Ghoshal and Bartlett (1986) define the 'strategic leader' as operating in a location with high strategic importance and itself possessing a high-level of in-house

competences. They suggest (1986: 80) that such a subsidiary 'serves as a partner of headquarters in developing and implementing strategy'. It will secure this status by building its own resource base and relative capacities from technologies and market insights accessible in its host economy.

[13] Of the various ways of categorising subsidiaries, it is the pioneering *scope typology* that most directly encompasses the strategic diversity we emphasise. This was originally generated through study of the roles of MNE subsidiaries in Canada (White & Poynter, 1984; D'Cruz, 1986) and later applied, in varied formulations, to the European context (Hood & Young, 1988; Young, Hood & Dunlop 1988; Hood, Young & Lal, 1994; Taggart, 1996, 1997).

[14] The discussion on the role of location specific advantages in cross-border R&D and innovation bears important similarities to the debate on the local nature of technological spillovers in the economics literature (e.g. Jaffe, Henderson & Trajtenberg, 1993). See Narula and Zanfei (2005) for more considerations on the links between these streams of literature.

[15] It is worth mentioning that he eventually dismisses the impact of foreign R&D as merely adaptive with most of high-valued added R&D functions to remain at home and thus producing little impact on host- countries development (Papanastassiou & Pearce, 2009: 161).

[16] See Zanfei, 2012; Filippetti, Frenz & Ietto-Gillies, 2017; and Bournakis, Papanastassiou & Pitelis, 2019, for more recent critical reviews on the effects of FDIs on economic performance of national and regional host locations.

[17] The differentiating impact of MNE activities on the developmental potential and sustainability of developing countries was addressed by Lall (2000: 30) who stressed the importance of government structural interventions as 'countries that are able to design and mount such interventions effectively can develop advantages far in advance of what endowment based theories would predict'.

[18] Although we take a transaction costs perspective, other theoretical perspectives such as resource based view, OLI, institutional and, cultural influences among others can provide the theoretical basis of the debate of mode of entry (Kogut &Singh, 1988; Svendsen & Haugland, 2011)

[19] One may incidentally observe that this is admittedly a limit of approaches based on transaction cost economics that, according to Williamson himself, 'has been less responsive in dynamic, evolutionary respects' (Williamson, 1992:337). See also Williamson (1988) for earlier considerations on the weaknesses of transaction cost approaches in dealing with these aspects of economic analysis.

[20] Belderbos, Leten, and Suzuki (2013) examine R&D location decisions of 156 R&D-intensive firms based in Europe, the United States, and Japan during 1995–2002, and find that the share of their global R&D activities conducted in the home country is not proportional to the general attractiveness of the country for multinational firms' R&D activities. They show that the extent of the home bias increases with the degree of scale and scope economies in R&D, the coordination costs of international R&D, and the embeddedness of firms' R&D in home countries' innovation systems. Technology leadership is associated with greater home bias if the home country provides relatively strong intellectual property rights protection, and firms face potential knowledge dissipation abroad.

[21] Le Bas and Sierra (2002) also consider a case wherein both the host location and the foreign investors reveal no technological advantage at all, and classify this as pure market seeking. They find that this case is the least frequent one (10% of all recorded cases). This is not surprising, since their sample is clearly biased in favour of high technology firms.

[22] Seminal empirical research has been conducted by Almeida (1996), who found that patents cited by foreign affiliates in the semiconductor industry in the US were more likely to originate in the US. However, he also supported the view that patents granted to foreign firms are cited more often than one would expect by other patents originated in the same region.

[23] Indeed, the importance of combining MNEs' external and internal networks was emphasised in international business studies in earlier times. Ghoshal and Bartlett (1990, 1995) among others do suggest that the existence of internal entrepreneurial networks is a fundamental condition for the exploitation of new opportunities and for the development of what they define as the 'externally-focused ability of the organisation to create new businesses' (Ghoshal & Bartlett, 1995: 145). However, their analysis is only incidentally focused on firms' ability to gain access to external *knowledge assets*.

[24] Quite consistent with the evidence we have illustrated on networking, Bournakis, Papanastassiou & Pitelis. (2019:166) found that 'regarding R&D activity of MNEs from specific origins signify the *negative foreignness effect* whereby domestic enterprises occasionally outperform foreign subsidiaries'.

[25] Furthermore, they argue that colocation is the outcome of a global innovation strategy rather than of individualized subsidiary decisions.

[26] It is worth stressing that co-location may also induce reshoring of R&D and manufacturing activities to the home country (De Backer, Menon, Desnoyers-James, & Moussiegt, 2016).

[27] An indirect measure of the importance of virtual teams is co-patenting of firms located in different countries, which has significantly increased in both core OECD and in EDCs as documented by Castellani (2017) using REGPAT data for the 1980-2011 period. Nevertheless, co-inventing activities remain a minor share of total patenting activities in all regions. Wholly owned subsidiary creation - whether established through greenfield investments or M&As – appear to prevail as a means to source new knowledge as well as to secure a speedy entrance in new markets that have pivotal impact in sustaining competitiveness (von Zedtwitz, 2004; Castellani & Zanfei, 2006; Castellani, Rullani & Zanfei, 2017; Ahammad, Konwar, Papageorgiadis, & Wang, 2018; Wei & Nguyen, 2017; Chaturvedi & Chataway, 2006; Awate, Larsen & Mudambi, 2015).

[28] This is a key feature of the abundant theoretical and empirical literature on the gravity equation initiated with Tinbergen (1962) to interpret bilateral trade flows. More recently these models have been extended to explain all sorts of cross-border economic transactions, such as FDIs (e.g. Kleinert & Toubal, 2010; Ghemawat &De La Mata, 2015), and even the exchange of 'weightless' goods such as financial assets (Portes & Rey, 2005), business services (Head, Mayer & Ries, 2009), and digital goods consumed over the Internet (Blum & Goldfarb, 2006). Once accounted for the size (and other characteristics) of the countries (Tinbergen's 'economic attractors'), the negative effect of distance on bilateral economic transactions is one of the most robust findings in economics (Anderson, 2011; De Benedictis & Taglioni, 2011, Leamer & Levinshon, 1995) and appears to persist over time (Disdier & Head, 2008)

[29] See Beugelsdijk and Frijns (2010), Slangen and Beugelsdijk (2010), Slangen, Beugelsdijk and Hennart (2011) and Schmitt and Van Biesebroeck, (2013) for recent applications of cultural distance to the analysis of exports, affiliate sales, cross-border asset allocation and outsourcing relations.

[30] While there are methodological differences on how to measure relevant distance factors, "when one disaggregates the concept of institutional distance, the overlap between psychic distance and institutional distance becomes quite substantial" (Dow & Ferencikova (2010: 48).